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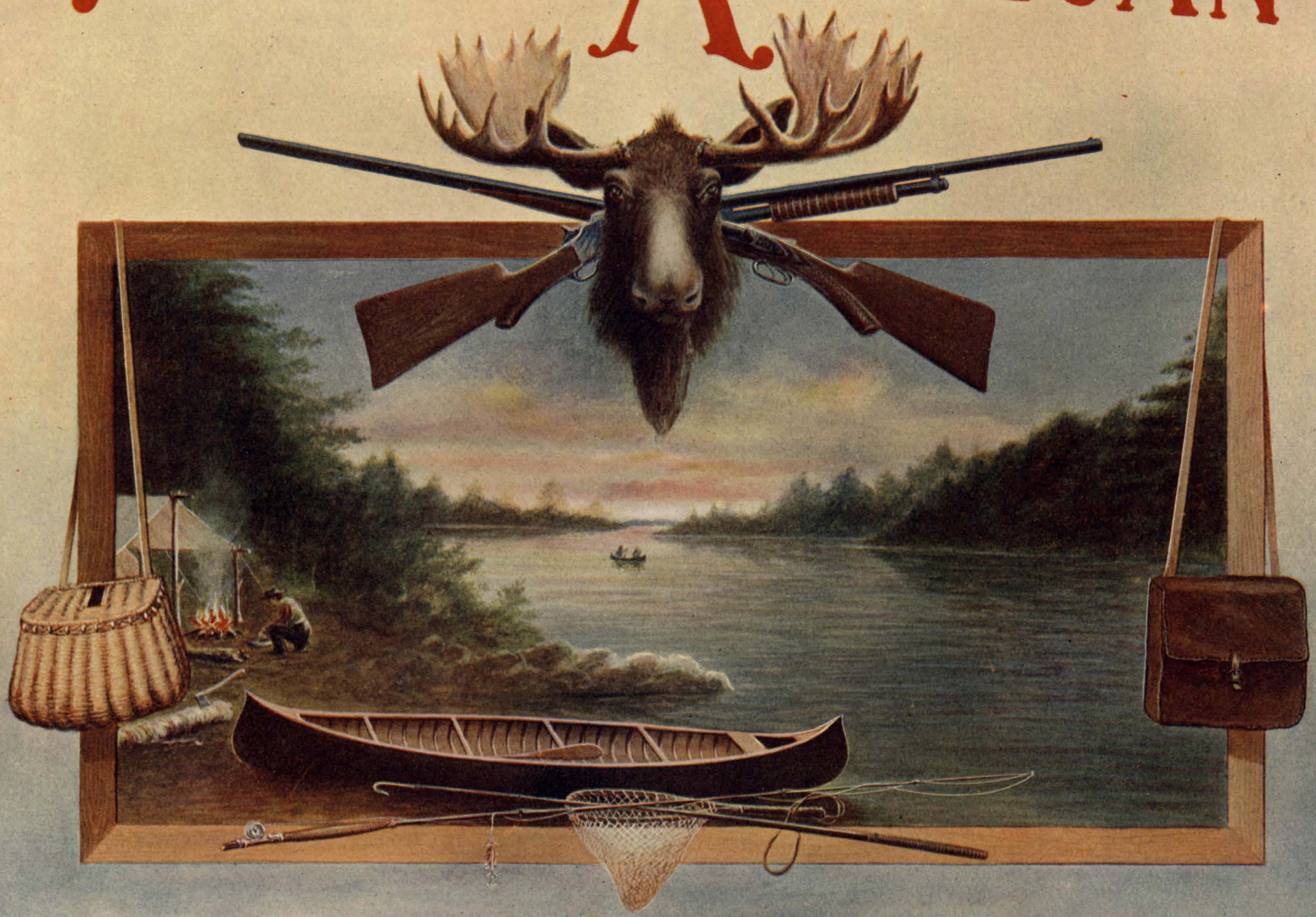

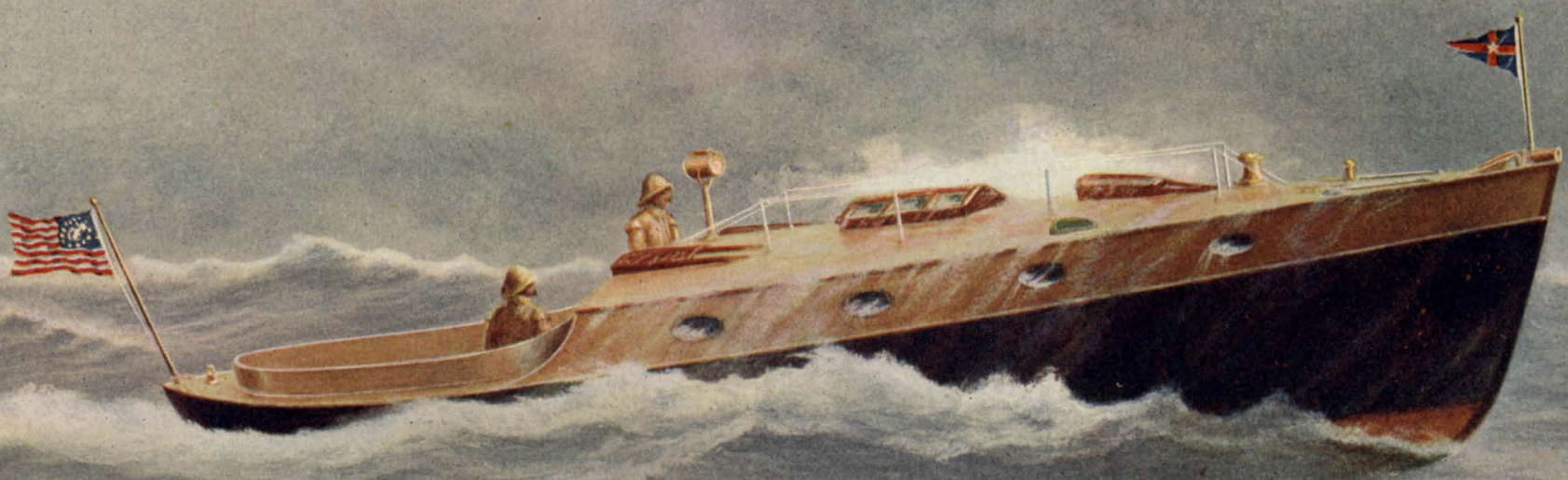

C. M. S. Knight-Smith 1908

SPORTSMAN'S NUMBER

FEBRUARY 29TH 1908
VOL. XCVIII-No 9

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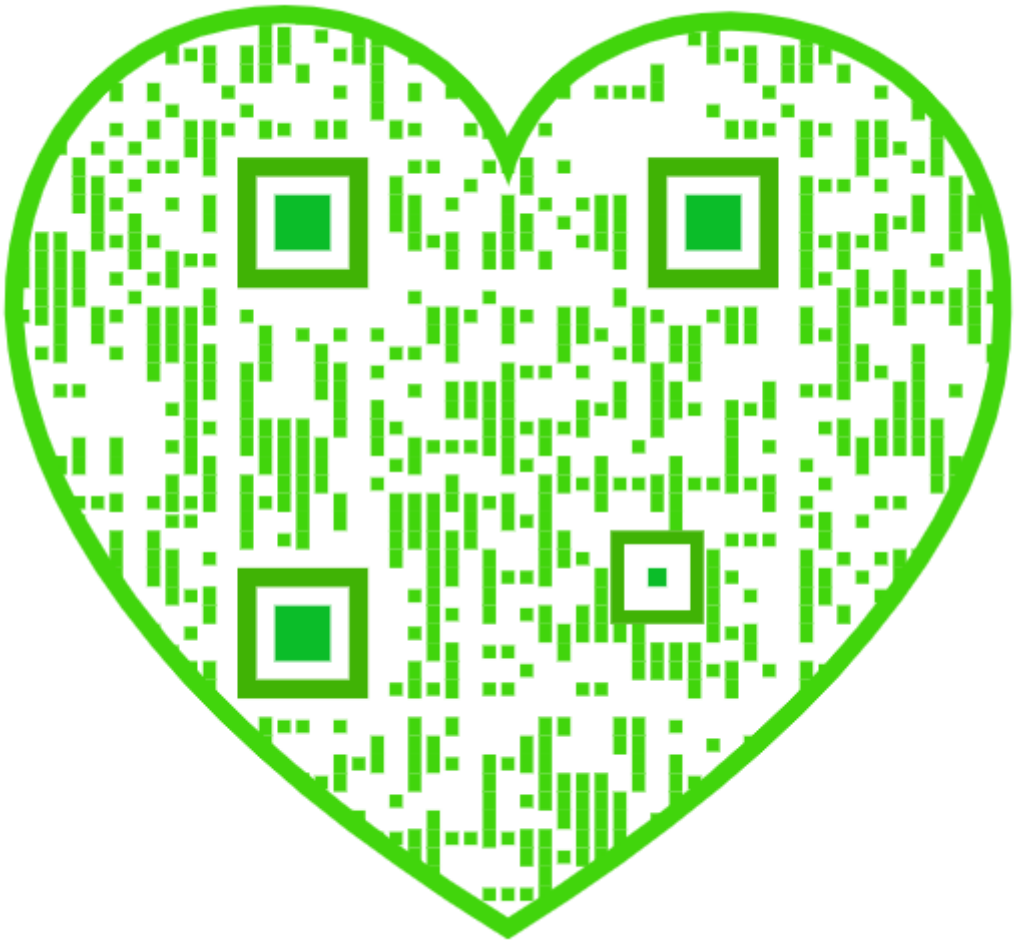

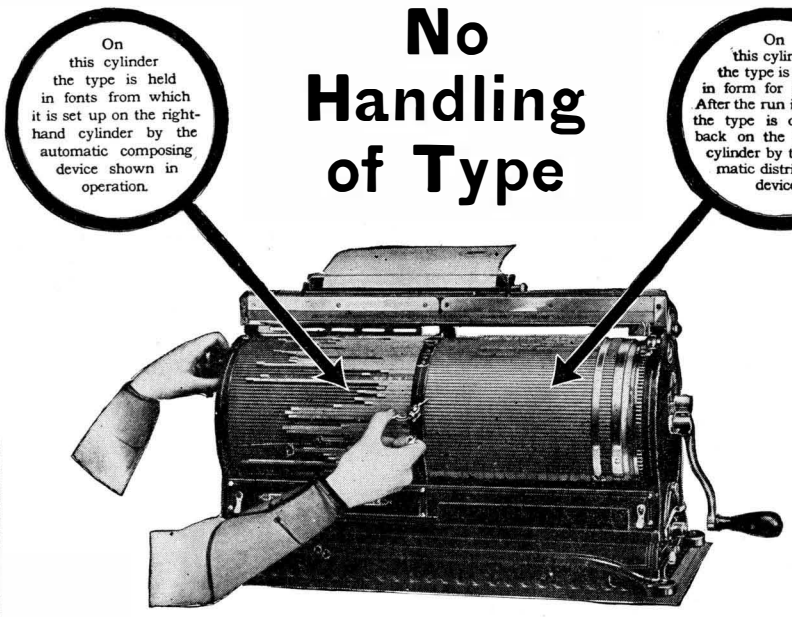
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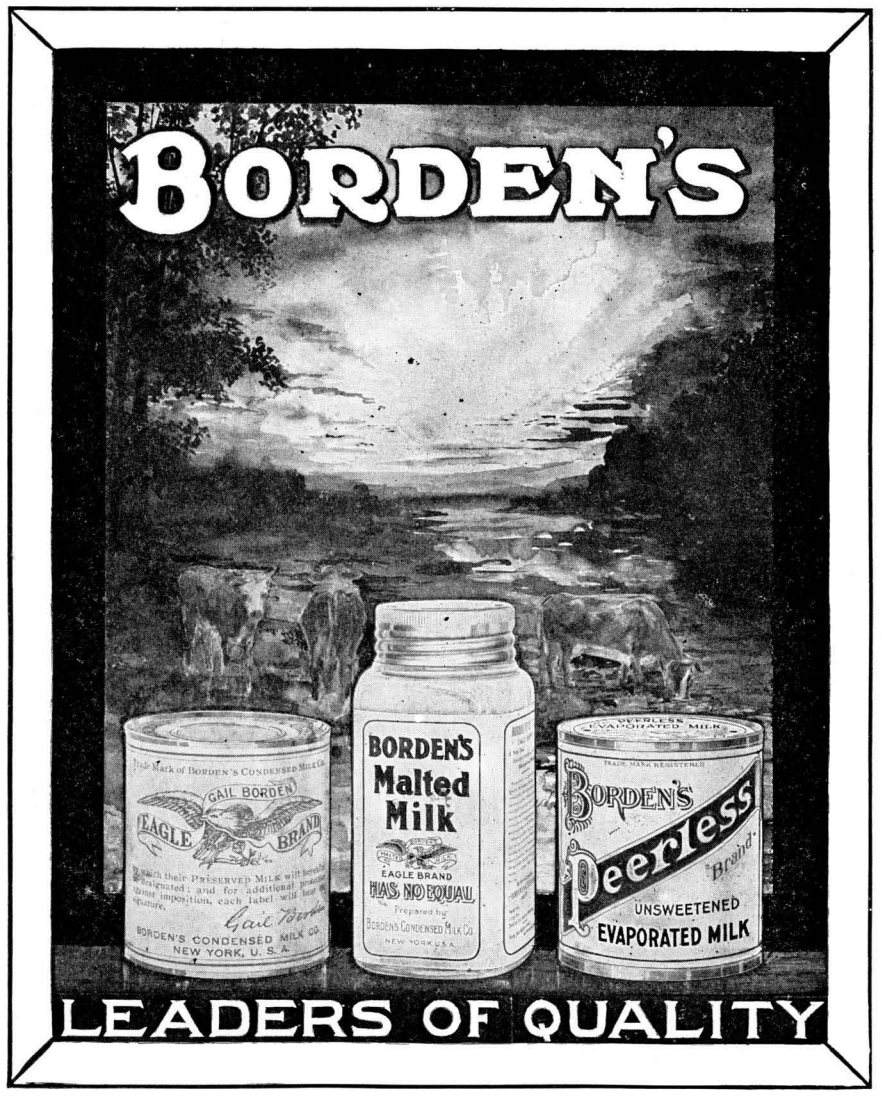

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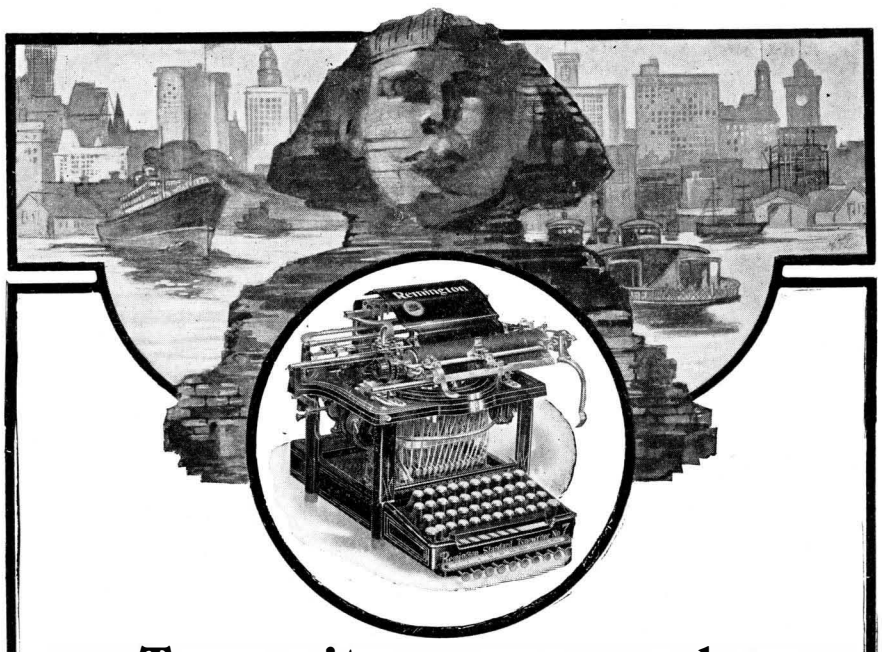

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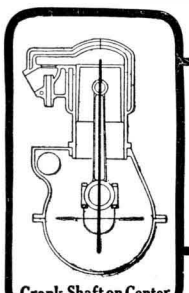

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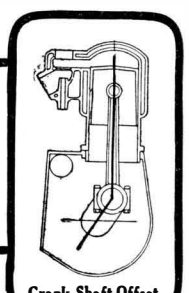

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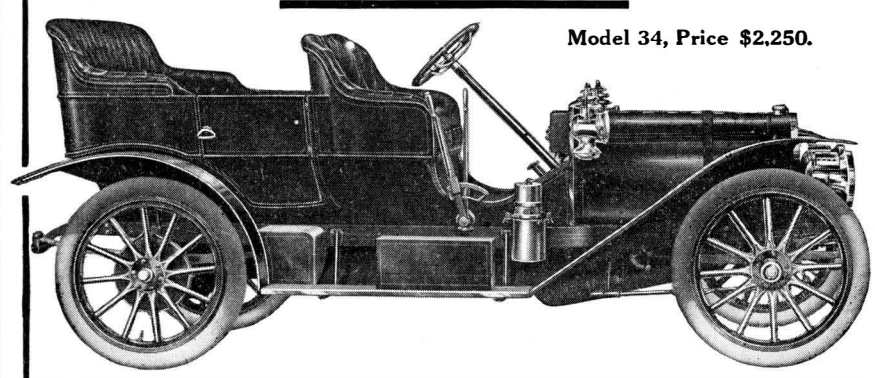

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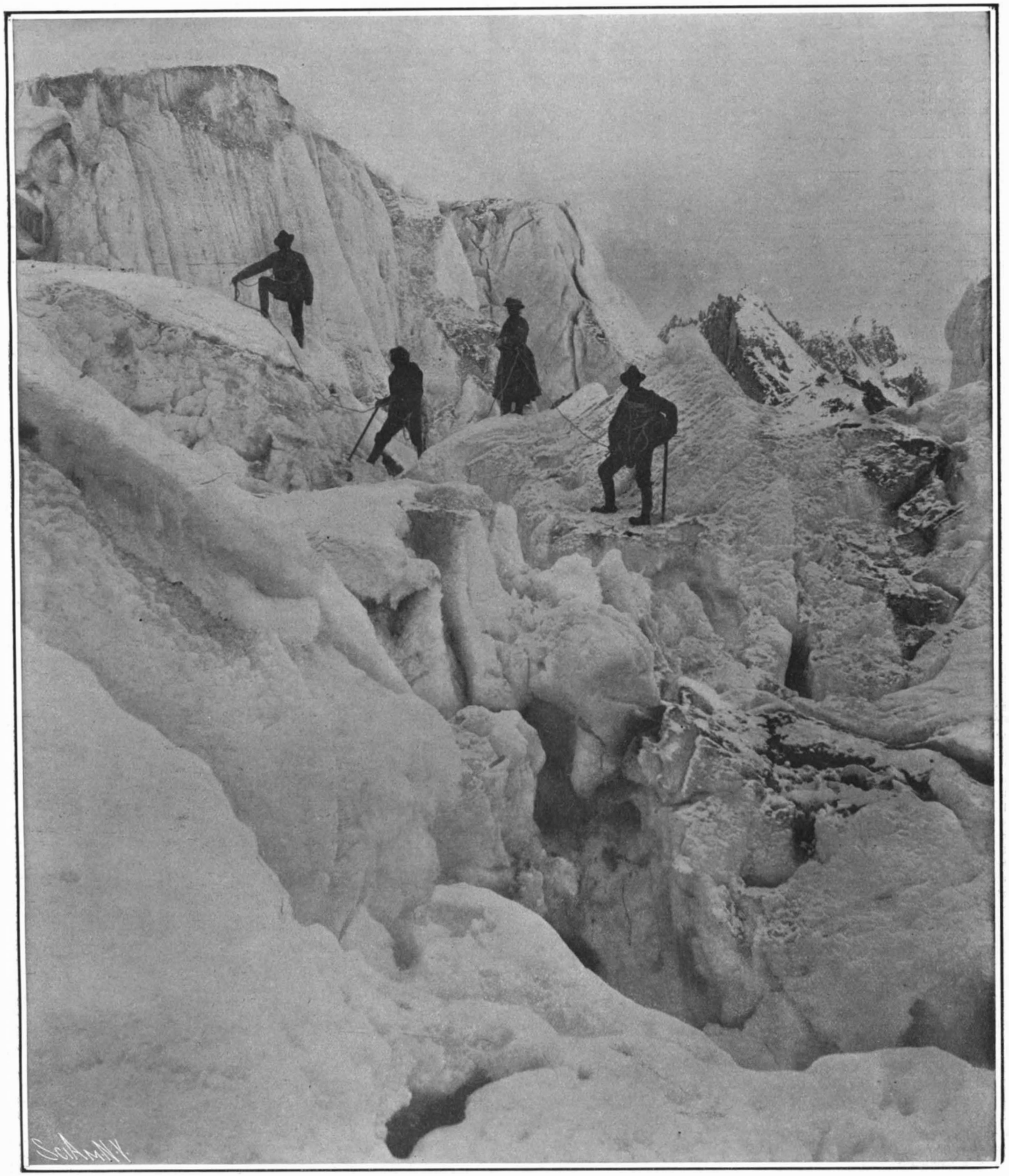

A Typical Bit of Rough Climbing Which the Workman Expedition Encountered.

MOUNTAINEERING IN THE HIMALAYAS.—[See page 144.]

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NEW YORK, SATURDAY, FEBRUARY 29, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SHALL AMERICA TAKE THE LEAD IN AERONAUTICS?

Signs are not wanting that the time is ripe for just such a rapid development of the art of navigation of the air, as was witnessed in the development of the automobile, when the French applied their great mechanical genius to that end. And we ask the question: Is the United States to take its proper place as the leading nation in this era of development, or are we to follow along, two or three years behind the rest of the world, and buy our dirigibles and aeroplanes from abroad, just as we were obliged to buy our first automobiles from France and Germany? There are reasons which make it peculiarly fitting that we should take the lead in the development of the most difficult art of navigating the air. Our government was the first to recognize the superior advantages of the aeroplane, by appropriating the liberal sum of $50,000 for the now classic Langley experiments; and was it not a couple of American civilians, the Wright brothers, who accomplished the first successful aeroplane flight for any distance? The work of these two, indeed, suffices of itself to put the United States far in the van in the development of mechanical flight; and that run of 24 miles at a speed of 38 miles an hour has never been seriously challenged. The recent work of Farman in winning the Deutsch prize in Paris, creditable though it was, was an insignificant performance compared with the long, swift flight of these two young Americans, in a machine which represented the results of many years of scientific investigation and experimental work in the air.

It must not be supposed that the $50,000 which was spent on the Langley experiments was money thrown away. On the contrary, the day will come when the valuable data gathered by Mr. Langley will be recognized as being fully worth the sum of money expended to secure them; and there is reason to believe that, if appropriations had been continued, the problem of aeroplane flight would have been successfully solved in those Potomac River experiments.

Aeronautical progress in this country has been greatly stimulated by the recent action of the War Department in calling for bids both for dirigibles and heavier-than-air machines; and the response has been made by the inventors of the country has been decidedly encouraging. The first advertisement called for a small, two-man dirigible, and half a dozen bids were submitted, of which one or two only were considered practicable. The War Department rejected all of the bids, however, and issued revised specifications, in which the bidders were required to furnish their own balloon material, the most important part of which was, of course, the envelope. These bids were opened on the 15th of February, and decision has not been made at the present writing.

The government has asked for bids for aeroplanes; and on the day of opening, February 1, no less than forty-one tenders were found to have been submitted, of which three were accepted, namely, that of the Wright brothers for a machine to cost $25,000; of A. M. Herring for a $20,000 machine, and that of J. F. Scott for one to cost $1,000. The first two machines are to be completed in six or seven months' time; and, judging from the past record of the inventors, it is reasonable to expect that out of this competition will come a thoroughly practical aeroplane. The competition for the construction of a dirigible has brought out the best men in the country, some of whom have had a long experience in aerial navigation; and, although the dirigibles which are now to be built will be much smaller than some of those which have done such good work on the Continent, we believe that the government, as the result of this competition, will be put in possession of one or more thoroughly practical airships, capable of performing the full duty called for by the specifications. Now that the War Department has lent its great prestige to the promotion of aeronautics, we feel that the time is ripe for an appeal to Congress for a sufficiently liberal appropriation to encourage the inventors, mechanics, and engineers of the United States to throw themselves into this promising field of endeavor, with something of the zeal which marked the efforts of the French in the development of the automobile.

It is high time that America moved forward to its former commanding position in the field of great inventions. Despite our brilliant record in the last century, in producing the reaper, the sewing machine, the electric light, the trolley, the telegraph, the telephone, and the typewriter, it must be admitted that of late years we have been somewhat outstripped by Europe in the introduction or development of epoch-making inventions. We cannot but feel that the solving of the most difficult of all mechanical problems attacked by man, that of air navigation, presents a field that should be peculiarly attractive to the genius of the American inventor. But, unlike many of the inventions which won for us worldwide distinction in the last century, the production of a successful airship or aeroplane necessitates the expenditure of a large amount of capital; and for this reason we believe that a liberal appropriation by Congress to the War Department, for the purpose of following up the good work which it has so well begun, would prove to be a national investment of lasting value.

UNDER-WATER ATTACK OF SHIPS BY GUNFIRE.

In the light of the experiments carried out last November by the British Admiralty against the old battleship "Hero," it would appear to be by no means impossible that the main point in Mr. Reuterdahl's recent attacks on the *materiel* of the United States navy may turn out to be in reality a very powerful defense. The fact that it has since been conclusively shown that the main armor belts of United States warships are not wholly submerged at full load draft does not alter the fact that this was the principal link—albeit the least powerful one—in his chain of attack.

As a result of those trials, the British Admiralty is now about to undertake a series of experiments, with the object of ascertaining whether the system of artillery attack offering the greatest prospects of success is not one which aims at placing high-explosive shells below the actual waterline of the vessel attacked; and if the result of the experiments should be to prove that such a system is a good one, it will at the same time be obvious that the best place for the main armor belt of the attacked ship is rather in the high than the low position.

The trials, which are to be carried out on the obsolescent battleship "Revenge" by the staff of the Whale Island Gunnery School at Portsmouth, have been decided upon as a result of the sinking of the "Hero" in the trials to which reference has already been made. The "Hero" was fired at on four separate occasions by battleships and armored cruisers of the Channel Fleet, and after the first bombardment she sank in about twenty-five feet of water, so that all her upper works still remained visible. After the firing, the ship was visited by a large number of officers and gunnery experts; but their examination utterly failed to show any reason for the vessel sinking. No armor-piercing projectiles were used in the trials, and the thick protection of the "Hero" was unperforated, while, so far as could be ascertained, no shot had entered above the belt and been deflected through the bottom. This could hardly have been the case, as the protective deck also was unperforated.

The theory put forward to account for the vessel going down is that a shell filled with a high-explosive charge struck the water some distance short of the ship, descended some feet below the surface of the water, and finally brought up against the unprotected side below the bottom edge of the waterline armor belt. The idea was put forward by a non-gunnery officer, and was at first scouted by the experts, who, as it happens, have made little if any study of the questions affecting ricochets.

Now, however, the theory is to be put to the test. The battleship "Revenge" is to take out to sea a specially-constructed target, which will have a large proportion of its area under water. Firing will be carried out at various ranges, from 1,500 yards upward, and at each range a series of shots will be fired; the object being to discover how far short of the target the sights must be adjusted to insure the shot striking at a sufficient distance below the waterline to escape contact with the main belt of armor.

If the experiments are successful, that is, if they show that this method of under-water artillery attack is feasible, there is no doubt but that it will be fully developed; for the effect of a high-explosive shell striking below the water level would be much the same as that of a torpedo. Even if such a shot did not sink the vessel struck, the inrush of water would considerably impair her stability. The damage occasioned by the same shell striking above the waterline would not be nearly so great; from which it will easily be seen that for a battleship to have the greater part of her main belt below water may prove rather to be an advantage than otherwise, especially if, as is the case with modern American vessels, there is a good secondary protection above the main belt. Besides, a submerged belt may conceivably prove a defense against torpedo attack.

SPEED OF GOVERNMENT AND PRIVATE EXCAVATION COMPARED.

The speed with which the rate of excavation of the Panama canal is increasing is one of the most encouraging features in the progress of that great work. It will be remembered that the grand total of excavation during the month of December, 1907, was 2,200,539 cubic yards. The totals for January show an increase of over half a million cubic yards for the month, or a grand total of 2,712,568 cubic yards. Of this amount, about two and a half million yards were taken from the canal prism, one and a half million yards of which were removed by steam shovels, and about 1,000,000 by dredges.

In this connection we feel compelled to make reference to a most unfair comparison which was recently made of the rate of excavation on the canal with that maintained on one of our new western railroads. Our esteemed contemporary Engineering News has recently drawn attention to the following extract from the New York Times, which serves to show the misleading character of these comparisons: "Mr. George J. Gould congratulates the officials of the Western Pacific Railway because with 8,000 men they have moved more earth and rock than the Panama Commission with a force of 30,000 laborers. The Western Pacific record for the first eleven months of the year was 11,471,300 cubic yards, more than half of which was rock, as compared with the 8,151,645 yards, chiefly of dirt, removed in the same period by the Panama Commission; and in addition to this three miles of tunnels were driven, 200 miles of main line track were built and ballasted, and immense quantities of stone, masonry, steel bridges, and other construction works were erected." Commenting on this statement, the New York Times said: "But for the contrast it affords with an expensive and much-heralded public work, this record of private accomplishment and economy might pass unregarded."

The SCIENTIFIC AMERICAN had occasion only recently to expose the fallacies underlying recent attacks upon government work as done in connection with our navy; and here we have a parallel case of misleading criticism based upon facts that are not facts, and half truths which are worse than no truths at all. Without discrediting the work done on the Western Pacific, it must be remembered that the conditions on that road were ideal for rapid work, as distinguished from conditions at the Isthmus, which are about as full of hindrances to rapid work as they can well be. On the western road the climate is healthy and bracing, and the weather exceptionally favorable for excavation. At the Isthmus the climate is extremely enervating and unhealthy, and the weather conditions most unfavorable, because of the extremely heavy rains which occur, for the excavation and transportation of large quantities of material. On the western railroad the working forces are composed of labor largely native or acclimated to the country; the contractors are within easy reach by rail of the necessary supplies; and, most important of all, the excavated material has to be hauled but a short distance to the fill, the material excavated from each cut forming the embankment of the adjoining fill. But at Panama the labor has been gathered from widely separated parts of the world; it is unfamiliar with the climatic conditions; and the excavated material, instead of being taken a few hundred yards to the dump, has to be hauled from two or three up to nine or ten miles before it can be unloaded.

Having these disabilities in mind, the record of work done on the canal shows that the palm for meritorious performance should actually lie with the canal, and not with the railroad. For on looking over the statistics, we find that from January to November, 1907, the grand total of excavation was 13,556,733 cubic yards; and that of this amount, 8,151,645 cubic yards of steam shovel excavation was taken out of the Culebra cut alone, and not, as the extract quoted above would imply, from the whole canal. We find, moreover, that so far from being "chiefly dirt," 58 per cent of the material was rock. The official figures show that an average of about 5,000 men was employed in 1906-07 in taking out this 8,151,645 yards of material, as compared with the 8,000 men required on the Western Pacific to remove 11,471,300 yards.

Now, the above is a fair sample of the injustice that

can be done to a great enterprise in the minds of the lay public, by an unfair and prejudiced handling of statistical figures. So far from the work now being done under our army engineers at the Isthmus being inferior in quantity to that accomplished under civilian engineers on one of our great western railroads, it would seem, if we take all the modifying conditions of climate, labor, and length of haul into consideration, to be greatly superior.

THE RELATION OF THE AUDUBON MOVEMENT TO THE SPORTSMAN.

BY B. S. BOWDISH,

The true relation which Audubon societies bear to the sportsmen of the country (and within the term I mean to include only *true* sportsmen) is very much misunderstood by a great many, among whom are some of the sportsmen themselves. While running the exhibit of the National Association of Audubon Societies at the Sportsmen's Show of the Forest, Fish, and Game Society of America, in New York, recently, several visitors expressed surprise to the writer that the Audubon societies should be thus joining with sportsmen. They went away assured that instead of there being any antagonism, the most complete accord existed between true sportsmen and the Audubon organizations. To some sportsmen inquiring as to the exact contentions of the Audubon societies, it was explained that they stood for the passage and enforcement of such laws as would insure the preservation of game, and for the absolute protection of harmless and beneficial non-game and insectivorous birds. In no case did this explanation fail to elicit prompt and hearty approval.

The real sportsman is a true protector of non-game birds. Their charm contributes greatly to the pleasure of his outings, and by them, in common with the rest of humanity, he is benefited in a practical way. In the matter of game, too, he stands for preservation, not for extermination, and his appreciation of actual conditions is far more accurate than that of the sentimental theorist, his sympathy more direct and personal. On the other hand, the cordial relation of the Audubon societies toward the sportsmen is shown by the results of their work. In North Carolina the State Audubon Society was in 1903 incorporated to perform the functions of a fish and game commission, and since that time has continued to serve the State with such general satisfaction to sportsmen and citizens that in February, 1907, the South Carolina Audubon Society was incorporated along the same lines. Alabama, a year since one of the worst States in the Union as to game protection, from which bobwhites were annually shipped by wholesale, early in 1907 adopted a bird and game law drafted by the most earnest and active Audubon worker in the State, and indorsed by the National Association, and the author of this law, John H. Wallace, Jr., was made Game Commissioner. As a result, the State, from being one of the most backward, has become one of the most progressive game protective States, and words of praise for the law and the Commissioner are heard on all sides from the sportsmen of the State.

Tennessee has now a very good game law, which the National Association of Audubon Societies was influential in securing, and Georgia, as a result of persistent effort on the part of the same organization, has greatly improved in this respect. In Texas, during the winter of 1906-7, Mr. Charles E. Brewster, game law expert and ex-State Game Warden of Michigan, was maintained at very considerable expense by the National Association for the purpose of educating the people and assisting the able secretary of the Texas Audubon Society, Capt. Davis, and the sportsmen of the State in securing the enactment of good game laws and providing for their enforcement. The result has been the correction of very serious abuses and the establishment of bright prospects for the preservation of the State's game. In Connecticut during the last session of the Legislature the influence of the National Association and the Connecticut Audubon Society was most potent in securing the enactment of a hunter's license law, which has met with the hearty approval of by far the greater number of sportsmen. The non-spring shooting law was also secured largely as the result of the efforts of these organizations. In Illinois the open season on woodcock and mourning doves has been shortened a month; the day's bag of waterfowl and ducks reduced from thirty-five to twenty, and for quail and other game birds from twenty-five to fifteen. In Massachusetts the National Association has contributed to the fund which is to be used in the experiment looking to the preservation from extermination of the remnant of the once abundant heath hen, now reduced to a few pairs on the island of Martha's Vineyard. In New Hampshire a law was secured making a five years' closed season on the wood duck and upland plover. In New Jersey the attempt last year to secure a non-spring shooting law resulted in the bill dying in the Senate Fish and Game Committee as the result of the opposition of one man. This year sportsmen have awakened to the conditions and necessities, and co-operation of the sportsmen's clubs is already so well assured as to give good promise of securing the passage of both this law and a hunters' license law.

One of the good works accomplished in New York has been the defeat of bills to permit the sale of certain foreign game birds in the closed season. These bills in various forms haye been introduced at each session of the Legislature for several years. The adoption of such a law would almost surely result in fraud, and the illegal selling, consequently killing, of native game birds.

In a paper of the limitations of the present one, it is obviously impossible to more than briefly touch on some of the more important work looking to game protection which the National Association of Audubon societies and the various State Audubon societies have accomplished in co-operation with the sportsmen of the country. As to the aims and principles of the National and State societies, they may be briefly summed up in a repetition of the statement that these organizations stand for the adoption and enforcement of such laws as will insure the continued preservation of all species of game, and for the absolute protection of all harmless or beneficial non-game birds and animals. They advocate the total abolishing of spring shooting, because by such wasteful methods many species of game are surely being brought to extermination; they advocate the adoption of a hunters' license, first because it places the cost of game protection on those who enjoy the sport of shooting, highest on the alien who is most frequently a violator of the game and non-game laws, next on the non-resident who does not otherwise contribute to the support of the State, and merely nominal on the resident sportsman, who is almost always perfectly willing to contribute to the support of his pastime; second, because it enables the game commission to keep tabs on who does the shooting, legal and otherwise; they advocate non-sale of game, because while there is a market for game, worthless individuals who would rather make a precarious living by shooting than to work for it will violate all game laws and disregard all bag limits, and such men and methods are a potent factor in game decrease; they advocate a closed season for a term of years on such birds as the wood duck, woodcock, and upland plover, which, sadly reduced in numbers, are threatened with extermination unless thus given a chance to recuperate. In the case of the wood duck, several hundred letters sent out by the association a few months since to prominent ornithologists and sportsmen throughout the country, asking the present status of this bird, elicited replies which almost without exception were to the effect that the bird had either entirely disappeared or had become exceedingly scarce in the locality of the writer, and it is a question if the case of the woodcock and upland plover is not even more desperate.

The methods by which the objects of the Audubon societies are sought to be obtained are: education of the people as to the economic and æsthetic value of the birds and wild creatures; legislation, the advocacy of good laws and opposition to bad ones; the employment of wardens to guard breeding colonies of birds. Their fellowship with kindred organizations is international, and their active assistance as far extended as the Bahamas and to the Game Warden of Prince Edward's Island. Sometimes sportsmen whose viewpoint is restricted by the limits of local experience and knowledge are inclined to disagree with some of the reforms advocated by the National Association, whose experience and knowledge of game matters covers the entire country. A non-spring shooting law does not always appeal to the sportsmen of a State when the neighboring States have no such laws; they forget that a beginning must be made somewhere, that simultaneous action by a number of States is almost impossible of achievement. However, the wider a sportsman's experience, the more completely do his views accord with the aims of the Audubon societies.

Practically, the Audubon movement came into the field when there was almost no protection of non-game birds, when some of the most valuable insect and weed-seed eating birds were slaughtered wholesale, when the seabirds were being fast exterminated for the millinery trade, and many States had almost no game laws, while the laws of others were a mere farce, owing to non-enforcement. To-day model non-game laws are in force in thirty-eight States, and game laws are far better, and better enforced than ever before, and tend constantly to improvement. This is largely the work of the Audubon movement, and it is no wonder that it meets with the hearty appreciation of sportsmen and nature lovers everywhere.

The introduction of electric traction on railroads that have long tunnels appears, says the Electrical World, to have had an extraordinary effect on the development of short and long tunnel schemes in Switzerland. Some of the plans for intercanton and international routes are very ambitious, involving sums as large as $55,000,000 in individual instances. Including local trolley enterprises, there are already in Switzerland 111 projects for which concessions have been granted. It is obvious that the execution of even a small number of these projects would not only require a very large sum of money, but would call for large quantities of hydraulic and electrical apparatus.

FLYING AS A SPORT—ITS POSSIBILITIES.

BY WILBUR WRIGHT.

Up to the present time men have taken up flying partly from scientific interest, partly from sport, and partly from business reasons, but a time is rapidly approaching when the art will have reached a state of development such that men can practise it without the necessity of maintaining a private laboratory or a manufacturing plant.

Considered as a sport, flying possesses attractions which will appeal to many persons with a force beyond that exercised by any of the similar sports, such as boating, cycling, or automobiling. There is a sense of exhilaration in flying through the free air, an intensity of enjoyment, which possibly may be due to the satisfaction of an inborn longing transmitted to us from the days when our early ancestors gazed wonderingly at the free flight of birds and contrasted it with their own slow and toilsome progress through the unbroken wilderness. Though methods of travel have been greatly improved in the many centuries preceding our own, men have never ceased to envy the birds and long for the day when they too might rise above the dust or mud of the highways and fly through the clean air of the heavens.

Once above the tree tops, the narrow roads no longer arbitrarily fix the course. The earth is spread out before the eye with a richness of color and beauty of pattern never imagined by those who have gazed at the landscape edgewise only. The view of the ordinary traveler is as inadequate as that of an ant crawling over a magnificent rug. The rich brown of freshly-turned earth, the lighter shades of dry ground, the still lighter browns and yellows of ripening crops, the almost innumerable shades of green produced by grasses and forests, together present a sight whose beauty has been confined to balloonists alone in the past. With the coming of the flyer, the pleasures of ballooning are joined with those of automobiling to form a supreme combination.

The sport will not be without some element of danger, but with a good machine this danger need not be excessive. It will be safer than automobile racing, and not much more dangerous than football. The motor flyers will always be somewhat expensive, as the best of materials and workmanship will be required in their construction; but there is a possibility that men will eventually learn to fly without motors, after the manner of the soaring birds, which sail for hours on motionless wings. In such case the flyer would be so small and simple that the original cost would be very moderate, and the fuel expense done away with entirely. Then flying will become an every-day sport for thousands. We may not live to see that day, but with thousands of buzzards, eagles, hawks, and sea birds giving demonstration of the possibility of soaring flight every day of the year, no good reason exists for asserting that human flight without motors is entirely visionary. Meanwhile the motor-driven flyers will become sufficiently numerous to afford great sport, not only to the amateur aviators, but also indirectly to the general public, for the flying-machine races of the future will surpass anything the world has yet seen as spectacular performances.

In ballooning, a few glorious hours in the air are usually followed by a tiresome walk to some village, an uncomfortable night at a poor hotel, and a return home by slow local trains. With a flyer, which returns the sportsman to his starting point, thus eliminating the uncomfortable features of the balloon trip, aerial sport will appeal to a wider class than has heretofore been the case.

SOME IMPRESSIVE WIRELESS STATISTICS.

That wireless telegraphy is becoming a powerful factor in overseas communications is shown by statistics collected by J. Erskine Murray. He gives the number of stations as 1,550, classified approximately as follows:

Commercial land stations, 195; merchant vessels, 170; lighthouses, etc. (government stations), 150; naval installations, 670; military portable installations, 55; experimental stations, 310. These 1,550 stations had been erected by the various companies in approximately the following proportions:

Telefunken, 41 per cent; Marconi, 20 per cent; De Forest, 6 per cent; Lodge-Muirhead, 3 per cent; Fessenden, 3 per cent; other systems, 27 per cent. As regarded commercial land stations the proportions were: Marconi, 32 per cent; other systems, 68 per cent. On merchant vessels: Marconi, 56 per cent; other systems, 44 per cent.

MODERN SEVEN-LEAGUE BOOTS.

The peculiar shoes or stilts shown in the accompanying illustrations have been patented by their inventor, an engineer of Leipzig, who calls them "curve shoes." They have broad soles and pneumatic tires, which make them peculiarly suitable for walking and running on sandy ground, but they work well on any kind of ground or pavement and in all seasons of the year. They are adapted for practical use, as well as for sport, and for girls and women as well as men and boys. In spite of the size and apparent clumsiness of the shoes they are said to make running as easy as it would be with bare feet. The shoe of the advanced foot strikes the ground with its hinder part, which is several inches behind the heel of the foot. Then, the other foot being raised, the body rolls forward on the curve shoe until the front end of the shoe is in contact with the ground. The length of the curve shoe is so great that a distance equal to twice the natural pace is gained at each step. The pressure of the shoe on the ground compresses a spring which, when the shoe is raised, impels it forward without requiring any exertion on the part of the wearer. By the use of the curve shoes the speed of walking may be doubled with the natural and easy motions of walking, which are far less irksome and fatiguing than the treadmill action, uncomfortable seat and festering of the hands of the bicyclist.

MODERN SEVEN-LEAGUE BOOTS.

NATURE'S FLYING MACHINES.

BY PERCY COLLINS.

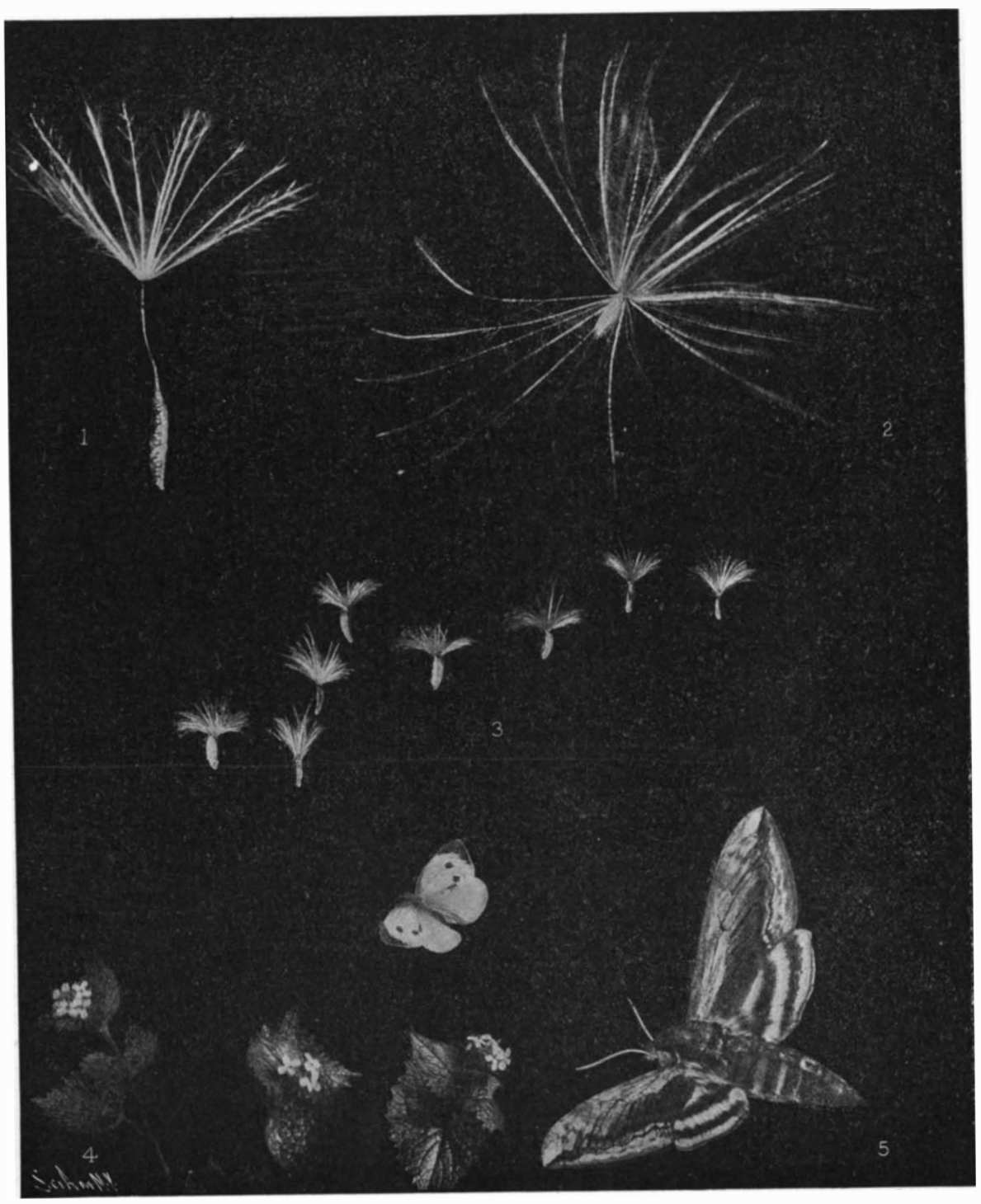
That men of invention and industry may learn lessons from nature is quite certain. Indeed, it is a matter of common knowledge that many of man's contrivances reflect nature to a remarkable degree. The duck upon the water is the prototype of the paddle steamboat; the tail of the swimming fish exemplifies the screw propeller; while a score of equally striking instances might be advanced. Thus, it is at least possible that a perfect knowledge of the laws governing bird and insect flight might enable man to build a machine which would fly through the air with precision, rapidity, and safety. We often forget that the balloon and the parachute, by means of which man has accomplished limited voyages through the dominion of the air, have their prototypes in nature. In this respect it may be said that man has learnt a lesson from the flowers of the field—or at least that he might have gained his knowledge from them, had he been so minded. We know that flowers are, as it were, the husbands and wives of plants. They bring forth the seeds which carry forward vegetable life from one year to another, and cause plants to multiply upon the face of the earth. But because flowers are firmly fixed upon their stalks, they are unable to give their seeds the start in life which is desirable. They cannot sprinkle them far and wide across the land. Thus, nature has come to their aid, and has invented many little contrivances whereby the seeds are dispersed and deposited upon soil suited to their needs.

Among these seeds are many specially equipped for aerial voyages. Examples will occur to the mind of every reader. There are, for instance, the seeds of the dandelion, the thistle, and the goat's beard. By means of feathery attachments all these seeds are rendered very light, almost as light as air, in fact; so that the smallest breath of wind is sufficient to support and carry them away over moorland and field. Eventually the same wind that lifted them will dash them to earth once more, and they will germinate and take root. But the point which the writer desires specially to emphasize is that these soaring seeds are, in effect, so many little balloons and parachutes. Take the seed of the common thistle, for example. The long, feathery rays which extend from it in all directions entangle, so to speak, the air. This reduces enormously the gravity of the whole contrivance. So that while the seed alone is heavy, and would lie prone upon the soil where it fell, its feathery attachments render it scarcely weightier than the air which it displaces. Thus, the thistle seed is virtually a balloon.

Still more striking is the resemblance between a dandelion seed and a parachute—while the same resemblance is noticeable in the case of other seeds. Let the reader glance at the accompanying diagram, which shows a parachute side by side with a vastly magnified dandelion seed. The seed proper hangs from a long stalk. It is the precious living thing—the little man, if you will—whose safe carriage through the air is demanded. At the other end of the stalk a vast number of stiff fibers stand out, stout enough to offer considerable resistance to the air, but sufficiently light and feathery to reduce the gravity of the whole contrivance to a minimum. It follows that the faintest puff of air beneath these fibers will suffice to carry the dandelion seed, in an almost perpendicular line, toward the clouds. Then, when once fairly started, it will be hurried away with the prevailing wind, traveling almost as rapidly as the wind itself.

Turning now from the vegetable to the animal kingdom, we find that certain creatures, while possessing no true powers of flight, are yet capable of making short trips through the air. One of these is the Australian flying phalanger, or "sugar squirrel" as the colonists call it. Its length, including the tail, which is rather longer than the body, is about nineteen inches. During the day it dwells in hollow trees, and at evening issues forth to exhibit the greatest agility in search of insects and the honey of newly-opened flowers. It rarely descends to earth, but passes from tree to tree by means of enormous leaps—true flying leaps, for it is sustained in the air by parachute-like expansions of the skin at the sides of its body between the limbs.

The phalanger's flight involves a combination of natural laws which need not be discussed in detail. A very simple experiment, however, will enable us to grasp the idea. Let us launch a piece of card



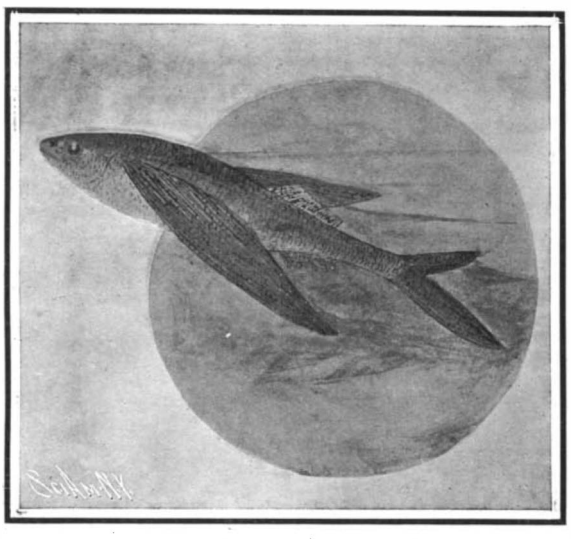
1.—Seed of goat's beard thistle. 2.—Seed of common thistle. 3.—Flight of seeds of dwarf plumed thistle. 4.—The common cabbage butterfly. 5.—Hawk moth. (These illustrations are not to scale.)

NATURE'S FLYING MACHINES.

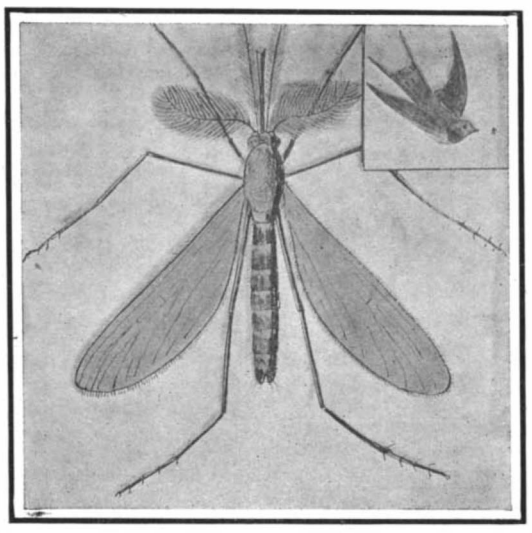
into the air in the manner shown in the accompanying illustration. Instead of falling rapidly to the ground as a stone would do, it soars upward to a considerable height, and then sweeps with equal grace upon a downward course, often returning almost to the feet of the thrower. It is, in fact, a simple form of aeroplane. The impetus supplied by our hand resists the pressure of the air against the broad surface of the card, which glides upward upon a bank of air, as it were, as long as the original impetus remains. When this is spent, the card glides downward upon another bank of air, this time being impelled by the force of gravitation, or, as we say, its own weight.

Let us now return to the flying squirrel. When it wishes to make its way from one tree to another at a distance it runs up to a high branch, leaps into the air and stiffens its limbs, thus spreading out its parachute-like membranes. This act presents a broad plane of resistance to the air, and turns the squirrel into something analogous to our piece of card. Its weight is so much greater, however, than the amount of air which it displaces, that the impetus of its leap carries it only a short distance in an upward direction. But at this point the squirrel shows itself superior as a living organism to our piece of card. Instead of sliding backward, it surmounts, as it were, a pinnacle of air, and rushes rapidly forward and downward. Moreover, ere it reaches the tree which is its goal, it soars upward once more, employing the impetus gained in its rapid gravitation, and thus breaks the shock which it would otherwise sustain when alighting. These maneuvers are rendered possible by the squirrel's power of altering the plane of resistance which its body presents to the air. When the impetus of its leap is expended it depresses the forepart of its body by a muscular effort, at the same time raising its hinder part. In this manner it utilizes the force of gravitation for its forward sweep. Then, its body having gained considerable impetus, it again reverses its plane of resistance, and sweeps gracefully up to the tree on which it alights.

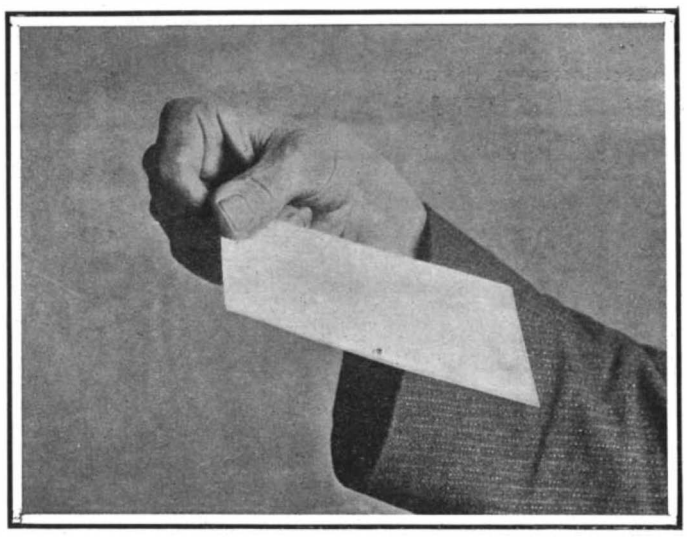
I have dwelt at some length upon the phalanger's mode of progress in the air because its principle explains the so-called flight of several other animals.



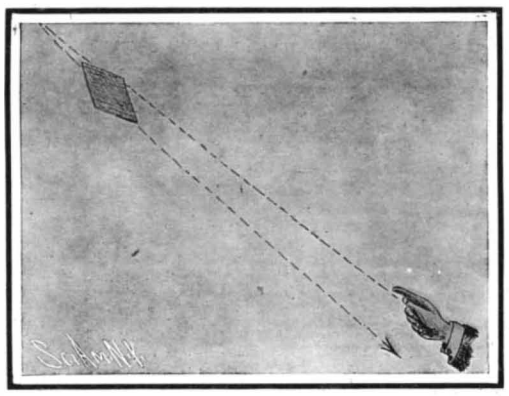
The Flying Fish Leaps From the Water and Skims Through the Air.



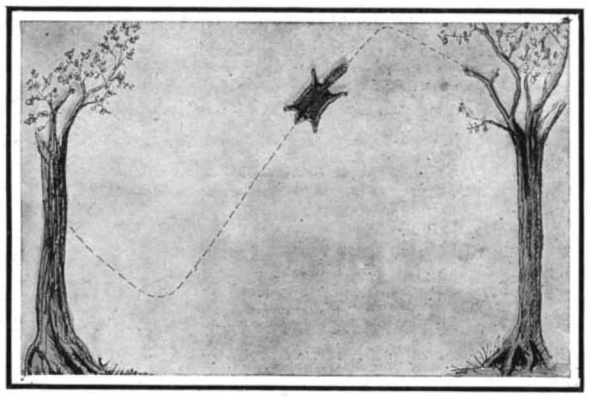
A Gnat's Wing Area is Proportionately Eleven Times That of the Swallow.



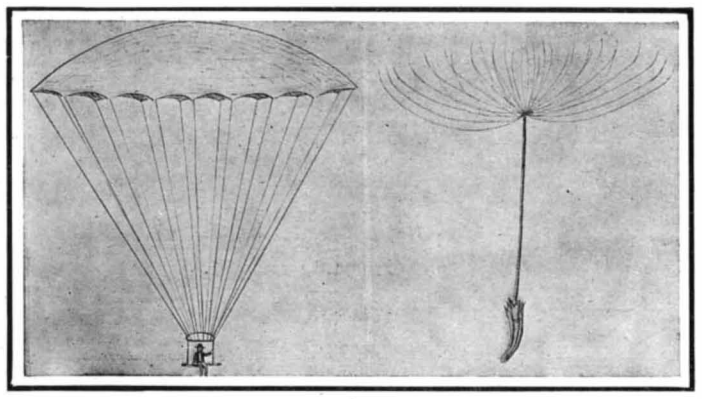
Throwing a Card to Imitate the Flight of a Flying Squirrel.



The Principle of a Squirrel's Flight.



The Flight of a Flying Squirrel.



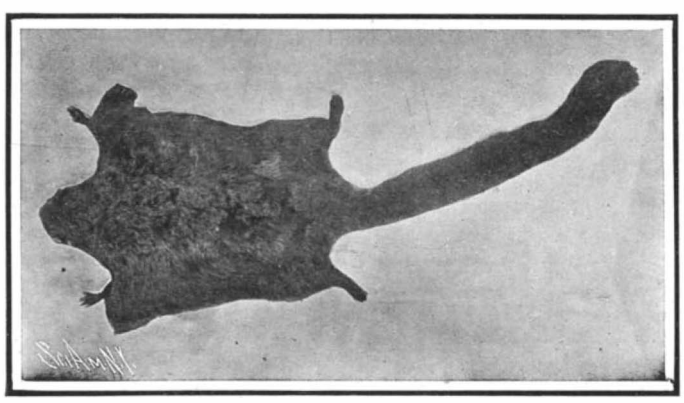
The Resemblance Between a Parachute and a Dandelion Seed.

Besides the phalangers, there are the flying squirrels of the northern hemisphere, and the flying lemurs. A few lizards, too, possess this power of gliding through the air; so, also, do the so-called flying frogs of Borneo and the neighboring islands. These frogs are sustained in the air during the vast leaps from branch to branch among the trees which they frequent by their enormous webbed feet. One of the frogs, when measured, showed that whereas the body was only four inches long, the fully expanded webs of the feet covered an area equal to twelve square inches. Bearing in mind our observations on the phalanger's flight, we shall not be at a loss to understand how a frog so equipped accomplishes its aerial journeys. In a word, these frogs simply glide upon the air, their big feet acting as aeroplanes.

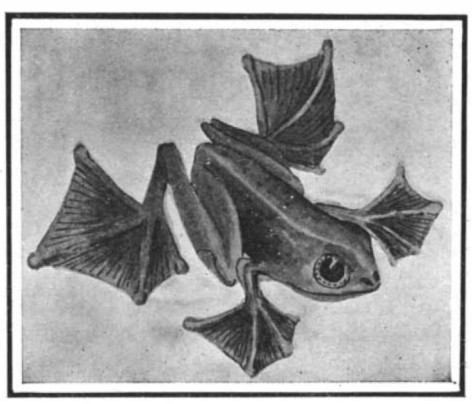
The same principle of flight is again seen in the flying fish, although at one time it was widely credited that these ocean dwellers possessed the power to accelerate their passage through the air by flapping their "wings"—as their enormously elongated pectoral fins are sometimes called. Had this been proved, these fish would have actually shared with bats, birds, and insects a power which has been denied to all other living creatures. But men of science are now agreed that the motion of the fins sometimes seen when the fish leaves the water is merely a continuation of their swimming movement, and in no way aids the passage of the fish through the air. The method of the fish's flight is this: It rushes through the water at high speed, hurls itself into the atmosphere, and spreading its huge wing-like fins glides rapidly forward until its momentum is exhausted. Then it drops back again into the water. So great is the impetus gained that these fish, under favorable conditions, will "fly" for a distance of 500 feet. But when once the impetus is exhausted, the fish is quite unable to sustain itself in the air by muscular effort.

In one respect at least, bats are the most remarkable of all the creatures possessing the power of true flight. Bats, as most people know, are mammals—they belong to the great class of "higher animals" which comprises man himself. Moreover, it is not a little remarkable that among the host of extinct animals with which, thanks to the labors of geologists, we are now acquainted, not one has been discovered in any way connecting bats with other mammals. Thus, bats stand alone; while how and why they became vested with the power of flight are questions shrouded in mystery. The framework of the bat's wing is furnished by the fore limb. Indeed, the bones corresponding to those of our own hand constitute its most important parts; hence bats are known as Chiroptera, or hand-winged animals. The thumb of the bat is free, and terminates in a hooked claw; but the "fingers" are enormously lengthened, while between them stretches a skin or membrane, to which, in certain species, the bones of the tail give additional support. All things considered, bats appear to be better models than birds for those who attempt to attain flight by mechanical means.

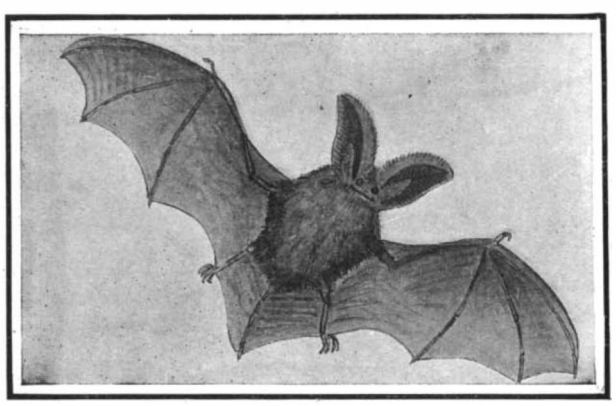
With reference to the flight of birds and insects, a few points only can be dwelt on in this place, although the subject possesses almost inexhaustible interest. In the first place, it is important to recognize that the wing is a flexible organ with a thick anterior and a thin posterior margin. It does not therefore beat the air like a board, but is thrown into a succession of varying curves. This enables the bird or insect to grasp firmly, as it were, the resistance offered by the air. The downward thrust thus given raises the bird or insect and forces it forward; then comes the ascending action of the wings, which are



Australian Flying Phalanger.



The Flying Frog of Borneo.



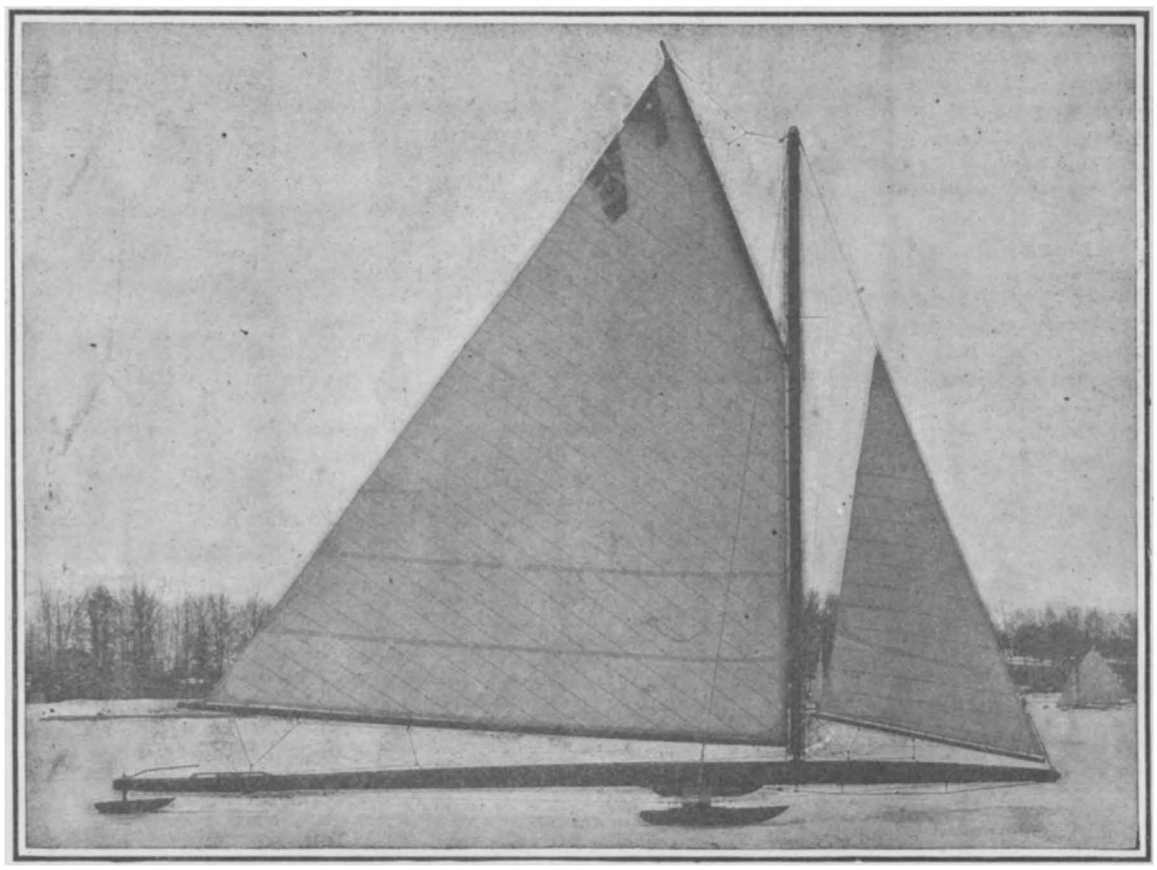
The Wing Spread of the Bat.

NATURE'S FLYING MACHINES.

guided in the same manner as a boy's kite, and sustain the body until the following stroke.

Weight is essential for flight, although we are accustomed to think otherwise. Without weight, the leverage necessary for a firm grasp upon the air, tho repeating at intervals the downward thrusts, is not forthcoming. Thus, we see that as the weight of bird or insect increases, the area of the wing decreases, a small wing moved rapidly being more effective than a large one moved slowly. The gnat, despite its comparatively feeble flight, has eleven times the wing surface of the swallow, reducing both to the same weight. Compare, too, the comparatively enormous wings of the cabbage white butterfly with those of the hawk moth, and these again with the wings of the bee or the fly. Experiment has shown that whereas the butterfly moves its wings only nine times each second, the moth attains a speed of seventy-two in the same period of time. Against this we must set the 190 flaps per second of the bee's wing, and the 330 of the fly's.

But there is probably another reason why weight is of importance in flying, besides the fact that it supplies leverage for the development of force. We know that (within certain limits imposed by our muscular strength) we can throw a large stone to a greater distance than a small one. We say that the former "carries" better than the latter. In other words, we mean that when once it is set in motion the momentum of a heavy body is far greater than that of a light one. It follows that the body of a bird or insect is of real importance in flight, and is not, as we too often imagine, an incumbrance. Once set swinging through the air by the movement of the wings, the body travels forward by its own momentum, just as does a stone when it leaves the hand of the thrower. Moreover, the body of a flying animal is so wonderfully adapted by its shape and balance to overcome the resistance of the air—to utilize, as it were, every ounce of force developed by the wings—that we cannot fail to recognize in it an indispensable asset in nature's scheme of flight. That this is not an exaggerated view the reader may discover by watching the progress of any small-winged bird, such as a chaffinch for example, when in rapid flight. Its wings move quickly for a few seconds, and are then actually shut, for an equal, or even for a greater, length of time. During this interval the bird is sustained and carried forward by the momentum of its body. The same thing may be observed in the quail, the woodpecker, and many other birds. In fact, it has been calculated that on a two-mile journey at a good speed, the time during which the wings of such birds are in actual use is considerably less than when they are passive.



An Improved Style of Ice Racing Yacht.

The economy of labor thus effected is obvious, while there can be little doubt that herein lies the secret of the power which enables birds to accomplish their vast migratory journeys.

AN ICE YACHT WITH A HOLLOW BACKBONE AND 250 SQUARE FEET SAIL AREA.

BY H. PERCY ASHLEY, I. Y. A.

For an all-around and fast ice yacht that can be used the greatest number of days the 250-square-feet sail area class has proved the most satisfactory. The advantages of this ice yacht are its light construction, comparatively small sail spread, with powerful driving power, which, combined with balancing power, make the essential for fast time on the ice.

The backbone and runner plank should be of well-seasoned basswood free from knots or checks. The spars are hollow and are of spruce; runners of seasoned best white oak; cockpit or steering box of white oak; top and bottom cap for backbone of white oak.

The general dimensions are as follows: Backbone or center timber over all, 30 feet; thickness, 4½ inches; width, 11 inches at runner plank; nose, 3¼ inches; heel, 4¾ inches; runner plank over all, 16 feet 8 inches; cut of runners, 16 feet; spread shrouds, 8 feet 5 inches; length of cockpit, 7 feet 6 inches; width, 3 feet 7 inches; depth, 4 feet. The total sail area is 248.60 square feet.

Construction of Backbone.—Select two pieces of well-seasoned basswood as dressed 30 feet long by 10 inches wide and 1¼ inches thick. Dress in shape of backbone which will be 2½ inches at nose, 4⅛ inches at heel, and 10 inches at mast and runner plank. The struts are of white pine, 2 x 2 inches, and are glued and screwed on the sideboards at an angle of 45 degrees. Start struts at the mast, which is 9 feet 6 inches aft of the nose. Oak 2 inches thick is inserted at the nose, mast, runner plank, fore end of cockpit and heel. (See Fig. 2, No. 13.) Nos. 10, 11, and 12 show inside mid-section and outside construction of backbone; 13 is the inside construction complete without the port side screwed in place. Firmly glue and screw with brass screws all contact parts. The backbone is capped on the upper and lower sides with ½-inch oak. The nose and heel end in a shoulder to receive the loops for wire rigging that form the runner-plank guys. (Fig. 1, deck plan.)

Runner Chocks, etc.—The runners are of seasoned white oak, pierced with ⅝-inch bolts with screw head. The runner shoe is soft cast iron. The cutting edge fore and aft has a downward curve of 1-16 inch. The dimensions of fore runners are as follows: Over all, 4 feet 8½ inches; depth of wood at center, 4¾ inches; width, 2¼, depth of shoe, 2¼. Rudder, over all, 2 feet 11 inches; width, 2 inches. Depth of oak, 3 inches; depth of shoe, 1¾ inches; rudder post, 1¼ inches circumfer-

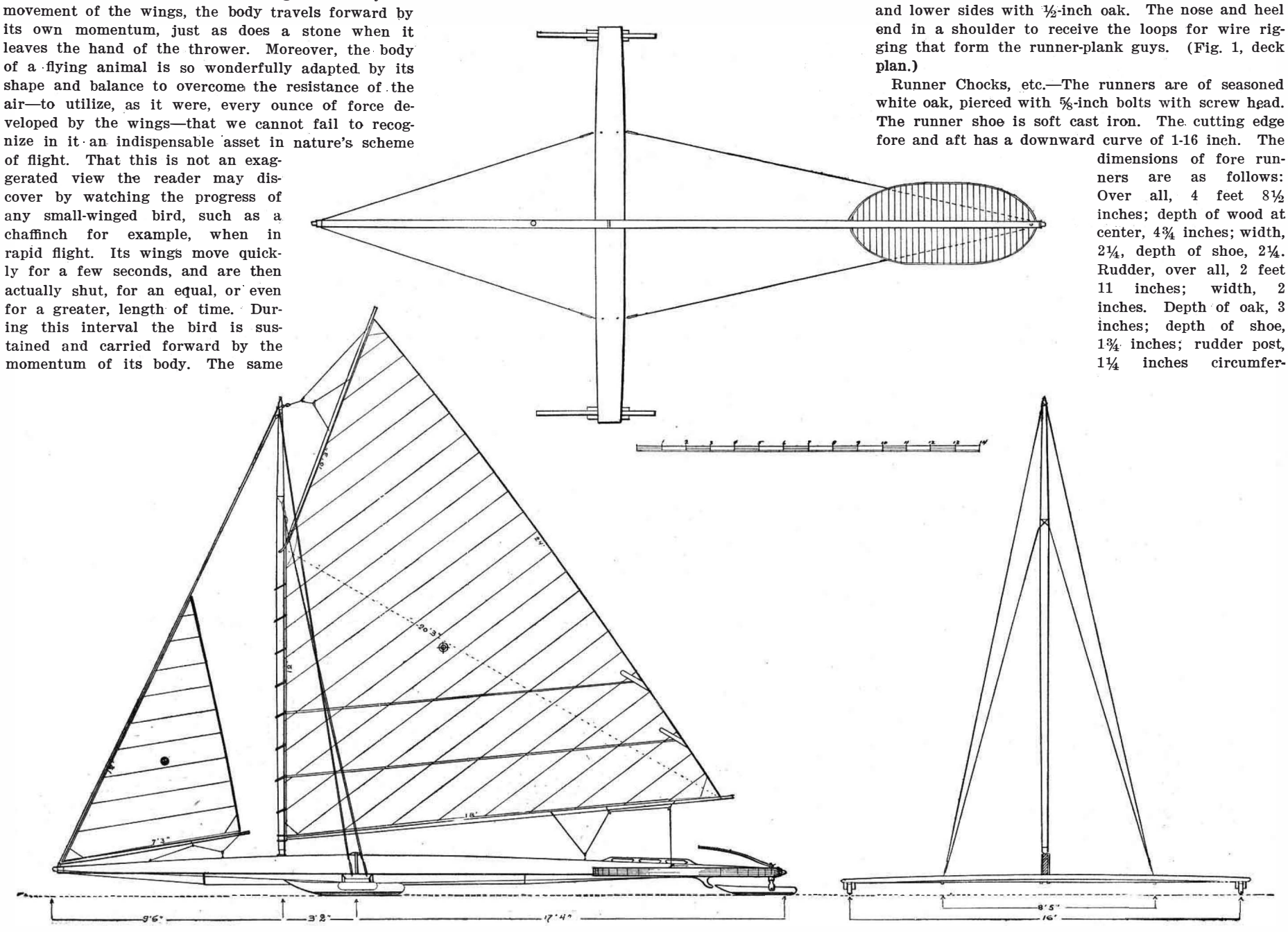


Fig. 1.—ICE YACHT CONSTRUCTION.—PLAN OF SAIL AND RIGGING.

ence; length of tiller, 3 feet. The chocks or runner guides are of white oak and are of the following dimensions: Over all, 21 inches; depth, 4 inches; width, 1¾ inches. They are fastened to runner plank with ½-inch lag screws. (See Fig. 2, Nos. 1, 3, 7, and 8.) No. 2 shows enlarged mid-section of fore runners. (See plans.) Runner plank is 16 feet 8 inches over all and the fore runners have a cut of 16 feet. The straddle of the shrouds is 8 feet 5 inches; width at ends, 12 inches; center, 13¼ inches; depth at center, 4¼ inches; ends, 2½.

Spars, Sails, Rigging, etc.—The spars are of hollow spruce. The dimensions of the sails are as follows: Main sail hoist, 12 feet; gaff, 10 feet 3 inches; leech, 24 feet; boom, 18; diagonal, 20 feet 3 inches; jib on stay, 12 feet; leech, 9 feet 9 inches; foot, 7 feet 3 inches. The standing rigging is ¼ plow steel, the running rigging for sails 5-16 for peak and jib halyards, and ⅜ diameter steel running rigging for throat halyards. The main sheet and jib sheet are rove through bull's eyes. The mainsail contains 212.60 square feet, jib 36 square feet, making a total of 248.60 square feet. The dimensions of the sails call for fully stretched.

The cockpit is 7 feet 6 inches long and 43 inches wide. It is formed of two bent oak strips 2 inches wide and 4 inches deep, with a groove in the under side to receive a flooring of tongued and grooved ½-inch oak 4 inches wide. All contacting surfaces are glued and screwed in place. The very best time to build an ice yacht is in the fall and it should always be built under cover. A canvas cover is essential to protect the cockpit from the weather. The bob stay is of ½-inch diameter Scotch iron and ends in a right-and-left turnbuckle with jam-nuts at the aft end. All shrouds and runner plank guys end in loops. The turnbuckles are ⅜-inch thread Tobin bronze and the blocks are No. 1 bronze with wire rope sheaves.

A number of these boats have been built with hollow backbones and have proved cup winners. They have been raced in gales, and are in as good condition as when first sailed.

The hull should be finished in fine sand-paper, one coat of light-colored filler, sandpapered, and two coats of the best spar varnish, the first coat to be pumice-stoned smooth. The illustration of the completed yacht made from a photograph shows clearly the distribution of sail area arranged to secure the greatest speed and stability.

Safe Illumination.

The eyes are injured by exposure to naked lights, and the injurious effect increases both with the brightness and with the area of the source of light. But no matter what the area may be, the illuminating power per square centimeter of that area cannot safely exceed 0.75 Hefner candle.

In order to follow the increase of brightness of artificial light from the beginning of civilization to the present day, I have measured forty sources of light, extending from the pine torch and the ancient Roman oil lamp to the metallic-filament electric lamp and the incandescent gas lamp. Of these only the pine torch, candles, open rape-oil lamps, and flat kerosene and gas burners fall within the limit of safety. All other lights should be inclosed in ground glass or matt glass globes. This applies to the tubular, central-draft kerosene burner, which is now so commonly used, and to acetylene and all incandescent gas lights.

Incandescent electric lights are still brighter, and their brightness increases with their candle-power. The most dazzling of all artificial sources of light, with the exception of the electric arc, are the new metallic-filament lamps, and particularly the Nernst lamp.

Of all lights now used, only candles and flat kerosene and gas flames fall within the limit of 0.75 Hefner candle per square centimeter of illuminating surface. The round kerosene burner exceeds this limit 5 fold, the incandescent gas light 8 fold, the carbon filament about 100 fold, the new metallic filaments 270 fold, the Nernst lamp 550 fold, and the electric arc 4,000 fold.

The competition among various systems of lighting too often leads to the employment of naked or insufficiently protected lights, in order to produce the greatest illuminating effect in proportion to cost. In most cases in which globes are used, they are added for artistic effect or to increase the illumination at certain points. In other words, the ceiling, rather than the eye, is protected from the direct rays of the lamp.

The best system of illumination for schoolrooms, factories, and offices is the indirect system, in which the sources of light are concealed and the light is reflected from ceilings, walls, and other large surfaces. Where this is impracticable, all lights which exceed the safe limit of brightness should be completely inclosed in non-transparent globes of such character and construction that they appear as uniformly luminous surfaces. The globes should be made of a kind of glass that absorbs the ultra-violet rays. These particularly injurious rays are largely eliminated by the indirect method of illumination.

Acuteness of Vision in Man and Various Animals.

Dr. Alexander Schaefer has been investigating the vision of many animal species and has found that the size of the eyeball is the principal factor of acuteness of vision. The bovine species has the sharpest sight. The second place is occupied by man and the horse, which have nearly equal visual powers, the third by the sheep. Small, and especially small-eyed animals, whether mammals, birds, amphibia, or reptiles, have very poor sight. Owls and buzzards are the only birds that possess great acuteness of vision. The low positions in the scale occupied by dogs, cats, bats, and many fishes, which feed upon living prey, is contrary to all expectation. In the case of dogs and certain fishes, lack of sharpness of vision is due to the great size of the retinal elements. It has long been known that dogs have such indistinct vision that as a rule a dog is not able to recognize his master by sight alone.

These results emphasize the distinction between vision of motionless objects and vision of moving objects. The latter faculty is necessarily keen in all animals of prey. A cat is little affected by the sight of motionless objects, but pounces on a fleeing mouse or a trailed string instantly and with unerring precision. A trout will rise to the most impossible artificial fly if its motion resembles that of a living fly.

The inclusion and position of man in the series are based upon the ocular measurements given by Helmholtz in his "Physiologische Optik."

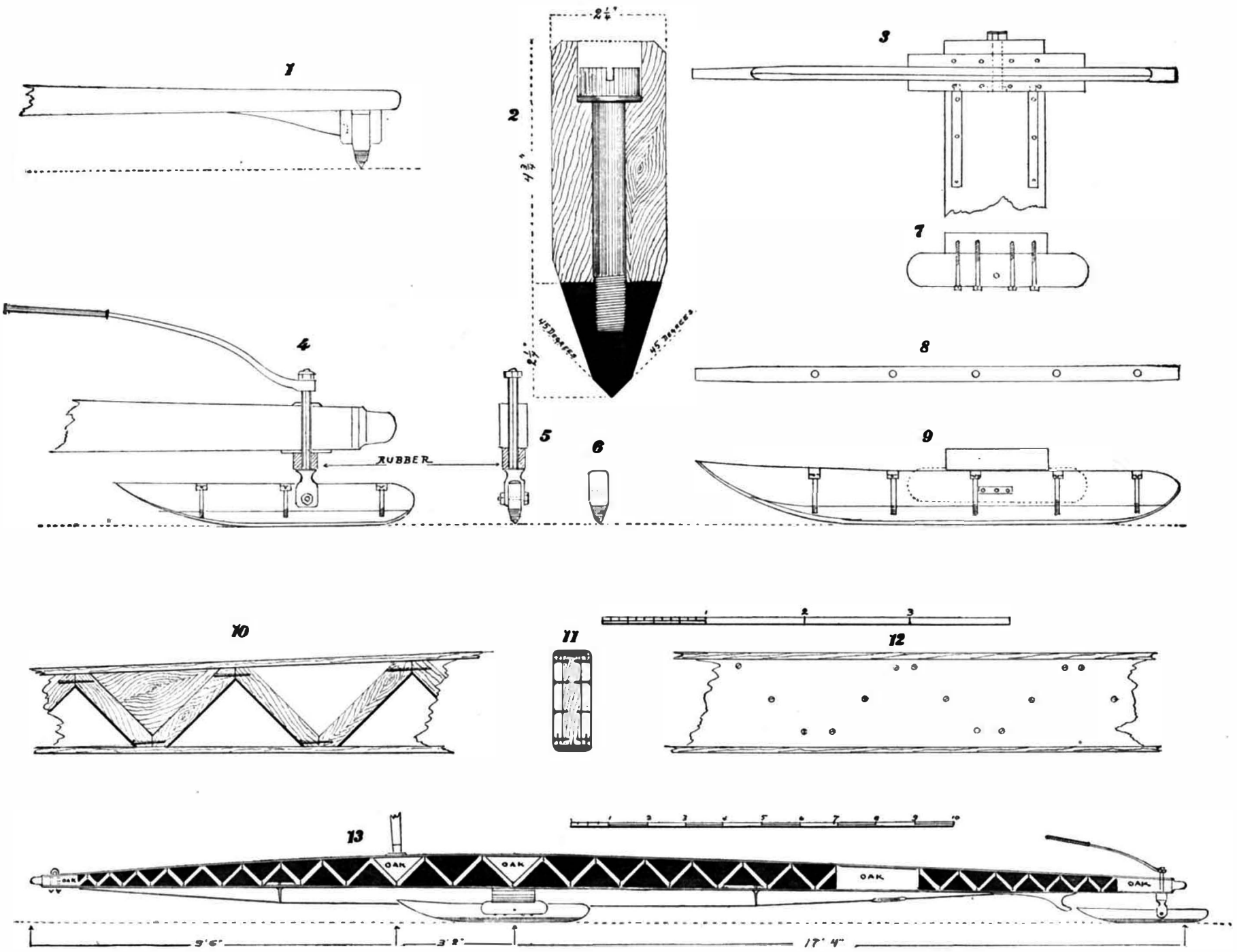


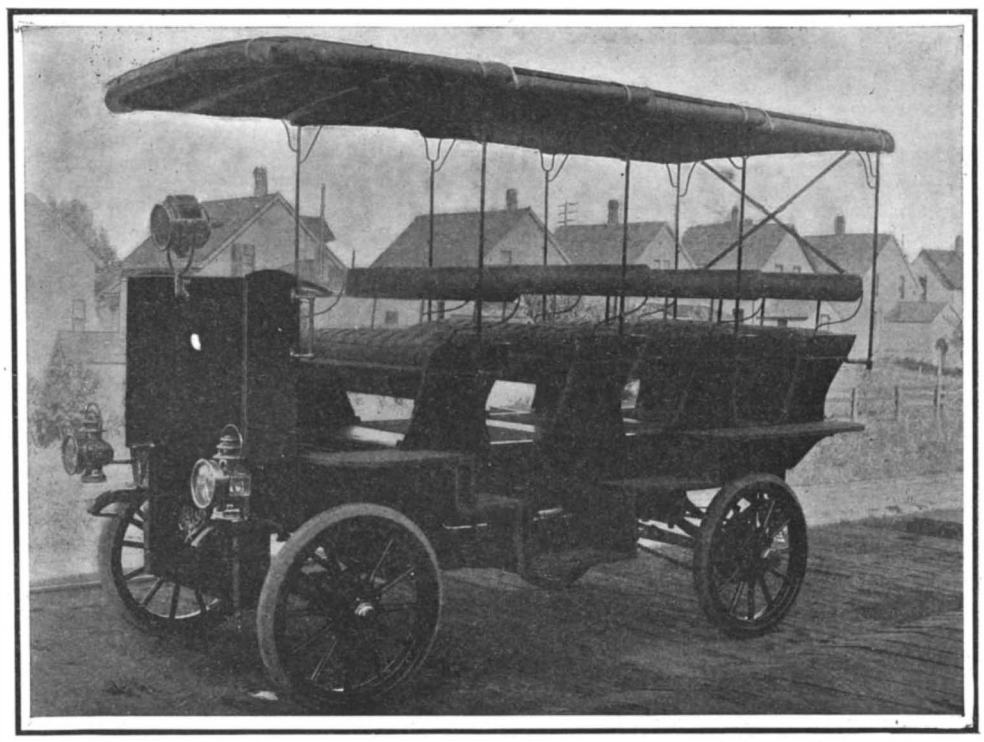
Fig. 2.—DETAILS OF ICE YACHT CONSTRUCTION.

1. Runner plank with chocks and brace. 2. Enlarged mid-section of fore runners. 3. Lower side of fore runner chocks and braces. 4. Tiller, rudder post, and rudder runner. 5. Mid-section of same. 6. Mid-section for runner. 7. Side view of chocks, showing lag-bolt fastening to runner plank. 8. Top of fore runner. 9. Side of fore runner. 10. Inside construction of backbone. 11. Mid-section construction of backbone. 12. Outside construction of backbone. 13. Inside construction of backbone complete without port outside plank.

A RECORD-BREAKING AUTOMOBILE BUS.

There is no doubt whatever that the most strenuous test that can be given a modern automobile consists in driving it at a relatively high speed for long distances over ordinary country roads. Few pleasure vehicles will survive a 600-mile road test without requiring the making of some minor adjustment; and when a commercial vehicle fitted with solid tires succeeds in competing with the ordinary pneumatic-tired pleasure cars in such a run, it is a feat worthy of record.

The photograph reproduced herewith shows a twelve-passenger sight-seeing car, made by the Rapid Motor Vehicle Company, of Pontiac, Mich. This car, carrying its full quota of passengers, completed the 600-mile cross-country reliability run of the Chicago Automobile Club last November at an average speed of 14 miles an hour. Despite the fact that the roads were in bad shape, and that in one instance the machine had to be driven through a flooded, unused road in order to regain the main highway, the bus completed each day's run upon schedule time. At several different times throughout the test the occupants of the car wagered that it would not be able to climb some of the steep grades encountered, but its simple double-opposed-cylinder motor and double-chain drive, on account of their combined efficiency, proved equal to the emergency, and in no instance was the machine stalled on a hill, or even in making a detour through a furrowed cornfield, where the wheels sank from 4 to 6 inches into the soil. The only adjustments made throughout this extremely difficult three days' test were the cleaning of a spark plug and the tightening of a pipe nipple. On one of the runs the driver forgot his tool bag, and the entire 200-mile distance was covered without any tools in the car. At the conclusion of the test the committee made a minute examination of all parts of the car and its mechanism, but they failed to find anything out of order. The chief penalization was caused the morning of the first day's run by breaking the seals on the coil box, which the driver believed to be short-circuited, but which, in reality, was not the case. This test was the first in which a commercial vehicle has been run on the same basis as a pleasure vehicle, and the result shows very clearly what excellent material goes into the construction of this particular make of car. All the Rapid vehicles are made upon a uniform chassis which has a horizontal two-cylinder motor with the cylinders located fore and aft of the frame, and which carries directly upon its crankshaft an extremely strong planetary transmission. The chain extends back from this transmission to the countershaft, and the final drive is by side chains to the rear wheels. The type of motor used and the method of power transmission make the car an economical one to run, while the special endless, solid tires are a decided advance over the type of tire used heretofore. The manufacturers of this machine make a large line of commercial vehicles, all of which are sold with a one-year guarantee. These automobiles are in wide use in this and in foreign countries, and their many users testify to the economy to be had upon their adoption in place of the usual horse-drawn vehicles.



AN AUTOMOBILE 'BUS WHICH COMPLETED A 600-MILE CROSS-COUNTRY RUN AT AN AVERAGE SPEED OF 14 MILES AN HOUR WITHOUT A REPAIR OR BREAKDOWN.

MOUNTAINEERING IN THE HIMALAYAS—THE HARDSHIPS OF CLIMBING AT HIGH ALTITUDES.

BY DAY ALLEN WILLEY.

When Mrs. Fanny Bullock Workman ascended Nun Kun peak of the Himalaya to a height of 23,260 feet above sea level, she made the world's record for mountain climbing by a woman, and a record which has been exceeded by only four men. This ascent concluded a series of five seasons spent in the great mountain range by Dr. and Mrs. Workman, during one of which they traveled 1,300 miles along what may well be called the "roof of the world." During four seasons they explored a glacial area of over 150 miles, including the famous Chogo Lungma in Baltistan, in addition to ascending nine snow passes ranging from 17,000 to 19,260 feet, none of which had ever before been surmounted by a human being. Eight virgin peaks were climbed, whose elevations varied from 19,000 to 24,000 feet, including the Nun Kun where Mrs. Workman made her highest ascent.

The Workmans have explored the high Himalaya more extensively than any other mountaineers. Consequently their comparisons of this region with the Alps and other mountains which have challenged the climber are of unusual interest. Mrs. Workman states emphatically that mountaineering conditions in Asia are far more arduous than those in Switzerland, the Rockies, and other mountain regions, but this is a fact which may not be realized by the Himalayan explorer on his first expedition. The glaciers, some of which are from 30 to 40 miles long, the snow passes varying anywhere from 16,000 to 19,000 feet, and the virgin peaks from 20,000 feet upward, are on a vaster scale than elsewhere.

Dr. and Mrs. Workman's early explorations assumed the character of an expedition, for they were sometimes accompanied by over 200 coolies in addition to the mountain guides brought from Europe for the work. These included, besides the famous Zurbriggen, the noted Italian mountaineers Petigax and Savage. On one journey their agent left Srinagar in advance with 243 coolies, as they were obliged to feed the men during the climbing weeks, and eight tons of rice and flour had to be transported to Suru, the base village; a second caravan followed of 25 loaded ponies, and later a third caravan started with 27 more. The large number was needed to carry supplies to the base camps, from which the actual ascents were made. After the camps were established, about 50 coolies were retained as porters, selected from the strongest and hardiest.

The success of most if not all of the ascents Mrs. Workman attributes largely to their care in so arranging camps as to insure maintenance. Only by spending nights at higher altitudes than Alpinists have ever before thus rested, did she succeed in her record exploit. Though necessary, the coolies prove one of the greatest obstacles to climbing in the Himalaya, since they are so unreliable and may desert at any time. In the exploration of the Chogo Lungma glacier, the Workmans determined to surmount two high summits at its head. To do this they arranged a series of camps to which food must be taken by the porters. In endeavoring to reach the high peak at the head of the Chogo Lungma glacier, the natives traveled so slow that Mrs. Workman left her husband to urge them on, and went ahead with a guide. To quote her account of her experience, it was weary work, for this part is stormy even in summer, and recent storms had left a covering of new snow, which reached to above their knees. Slowly they zigzagged up a high wall, stamping their feet often, for at that altitude it was bitterly cold. They were above 20,000 feet when an imperative summons from the others stopped their progress. Calling down to know the reason, the answer came that half the coolies had mountain sickness and the remainder refused to advance. The coolies remained obdurate, and finally, as there seemed no other way, they descended to where the men lay as if dead in the snow. In reality only a few were ill, but the remainder were obstinate in their refusal to go on. They were led downward a few hundred feet, and, taking another course, steered for a small high plateau where camp was pitched at 19,355 feet. On the morrow the porters were left behind, and the Workmans completed the ascent with only two companions.

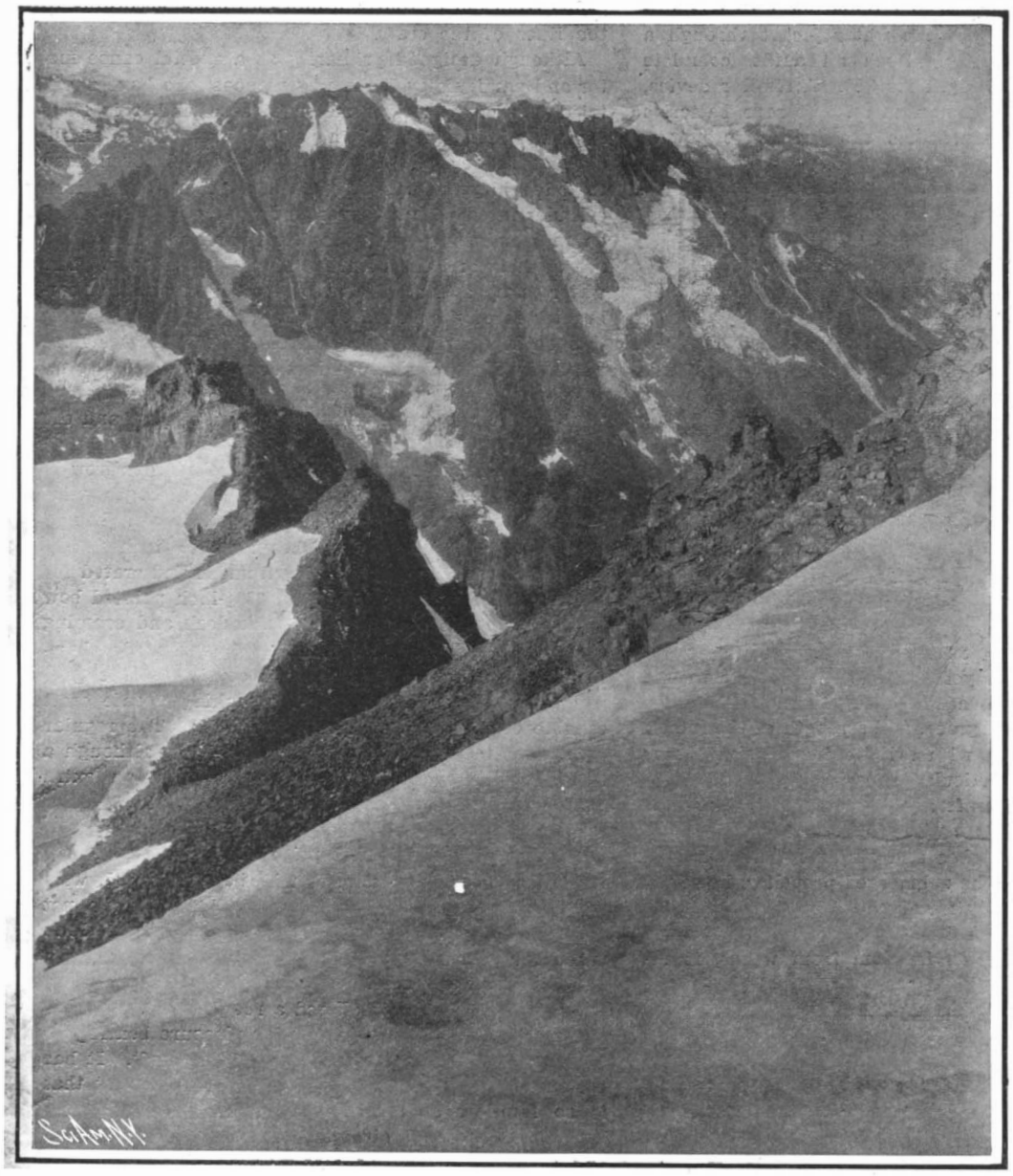
Intense cold was experienced, especially when Mrs. Workman made her highest ascent on Nun Kun. With the mercury often below zero at times during the day, by far the greatest suffering was endured at night, as the effects of the cold combined with the rarefied air made sleep actually impossible, and incredible as it may seem, for five nights the woman mountaineer did not slumber an hour in her tent. On this expedition Dr. and Mrs. Workman were accompanied in the higher explorations only by the guide Cyprian Savage and six porters from the Italian Savoy district. A base camp at 15,100 feet altitude was first located. From here in midsummer the party started for the Nun Kun peaks, crossing moraines and wading glacial torrents. On the long inclines they came upon large stretches of "nieves-penitentes," small corrugated ice pinnacles from one to three feet high, known in the Andes, but not seen before in the Himalaya. They pitched tents at 17,657 feet, where a good sleep fortified them for what was little suspected—five completely sleepless nights. The next day's climb took the caravan over a sharp snow wall, where steps had to be cut, then up ascending snow cotes gashed often by icicled crevasses. At last they arrived on the snow slant, and established a camp at 19,900 feet.

Next morning there was a high ice wall to be negotiated, rising at a severe incline. The Nun Kun seemed bent on furnishing them a very forbidding stairway to its unknown uplands, and the word "halt" was called every five minutes. After ascending straight for over an hour, they had to cross the ice wall in the center. Almost touching their elbows as they moved rose a tall ice canopy, while beneath them the wall dropped straight, a 500-foot ice sheet, at the base of which opened a blue chasm corniced with ice ruffles, ready to engulf the whole party should any take an awkward step. At last they were obliged to halt on account of fatigue, at 20,632 feet. Desolate fog shrouded the camp, and presented a weird scene. The night was so cold here no one slept, but they managed to push forward the next day to the final camp, where tents were pitched on a small snow flat. Fog and snow set in as on the previous day, but it finally ceased snowing. The sun shone through the sickly mist, and then overpowering heat prevailed. It was so unbearable within and without tents that the Alpinists were obliged to wrap their heads in wet towels. At 2:30 in the afternoon, the sun temperature was actually 193 degrees. Soon after sunset it froze, and at 7 o'clock the mercury was 22 degrees below the freezing point, while the lowest temperature for the night was four below zero. Thus in twelve hours the party experienced a fluctuation in temperature of 197 deg.

The night passed here was horrible. The climbers were sleepless and bitterly cold. The water froze in their bottles, and although thirsty, they had nothing to drink. With three sleepless nights, they felt nearly exhausted, but strength came with movement, and after nearly three hours of constant step cutting on slopes swept again and again by dangerous ice falls, they had gone surprisingly far up the mountain. At 22,700 feet they stopped for some lunch, and, nicking out snow hollows that they might sit, each indulged according to appetite in tinned meat, biscuits, or chocolate. Clouds were coming in, and, as Dr. Workman wished to use the camera before they covered the peaks, he and one porter remained at this point, while Mrs. Workman with Savage and the other porter continued the ascent. This was now almost wholly over a rock *arête*, and, as it is much more arduous climbing on rock than on snow above 22,000 feet, the difficulty of breathing became extreme. Stopping every few steps to rest, they crept on, and at last halted on a rocky pinnacle, the topmost point of the summit. Mrs. Workman had gone higher above the sea level than any other of her sex.

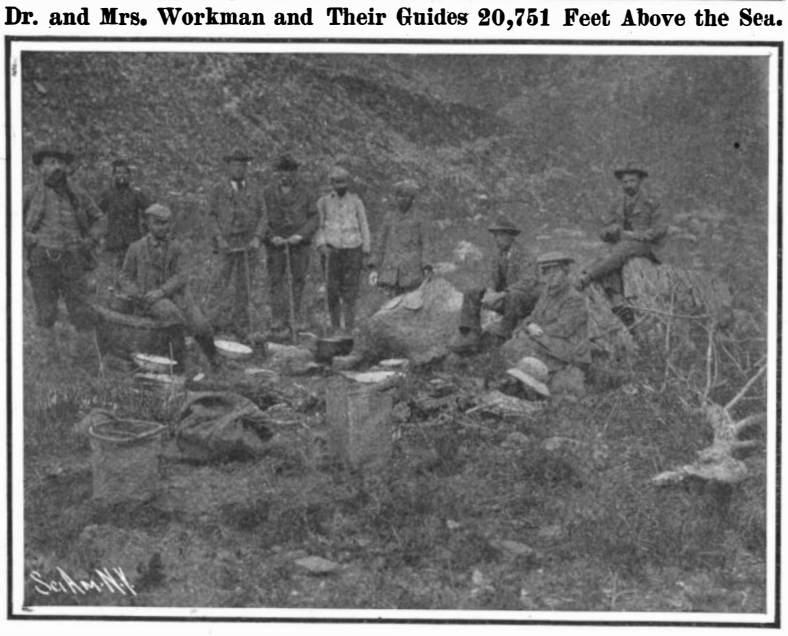
This brief outline of Mrs. Workman's principal exploit shows that the adventurer in the high Himalaya must be prepared to perform every kind of mountaineering work—not only rock climbs, but ice climbs, snow climbs, and level glacial work; while the rope is indispensable during most of the ascent, whether it be to the summit of a snow pass or to the top of one of the greater peaks. Statements which have been made by those familiar with other mountains, that the Himalaya afford easy climbing, are erroneous according to Mrs. Workman, who admits that during the journeys of her husband and herself, they saw fully a score of rock peaks which it would be simply folly for human beings to attempt, owing to the sheer descent of their slopes and the extent of the ice formation upon them.

Reports show that 12,091 tons of tin, valued at over $7,300,000, was produced in Australia during 1906, being 1,725 tons more than in 1905. The following quantities of tin were mined last year in each of the producing States: New South Wales, 1,300 tons; Queensland, 4,823 tons; Tasmania, 4,473 tons; and Western Australia, 1,495 tons.

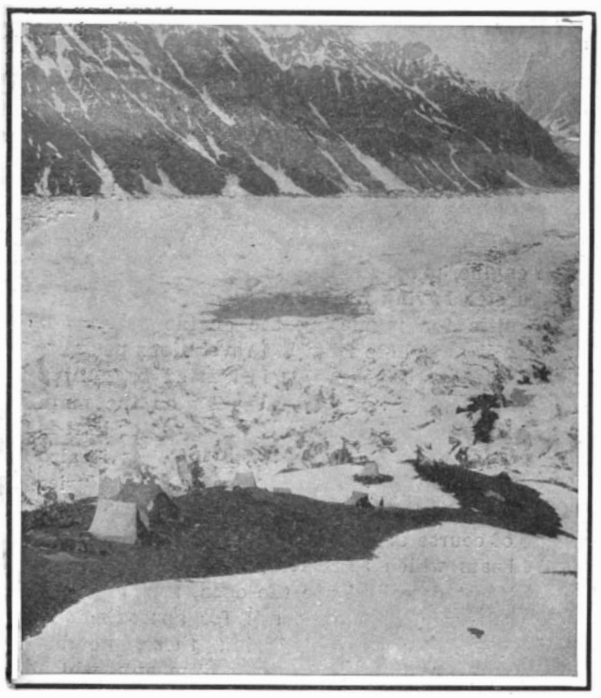


An "Earth Avalanche;" Loose, Disintegrated Rock Which a Touch May Set in Motion.

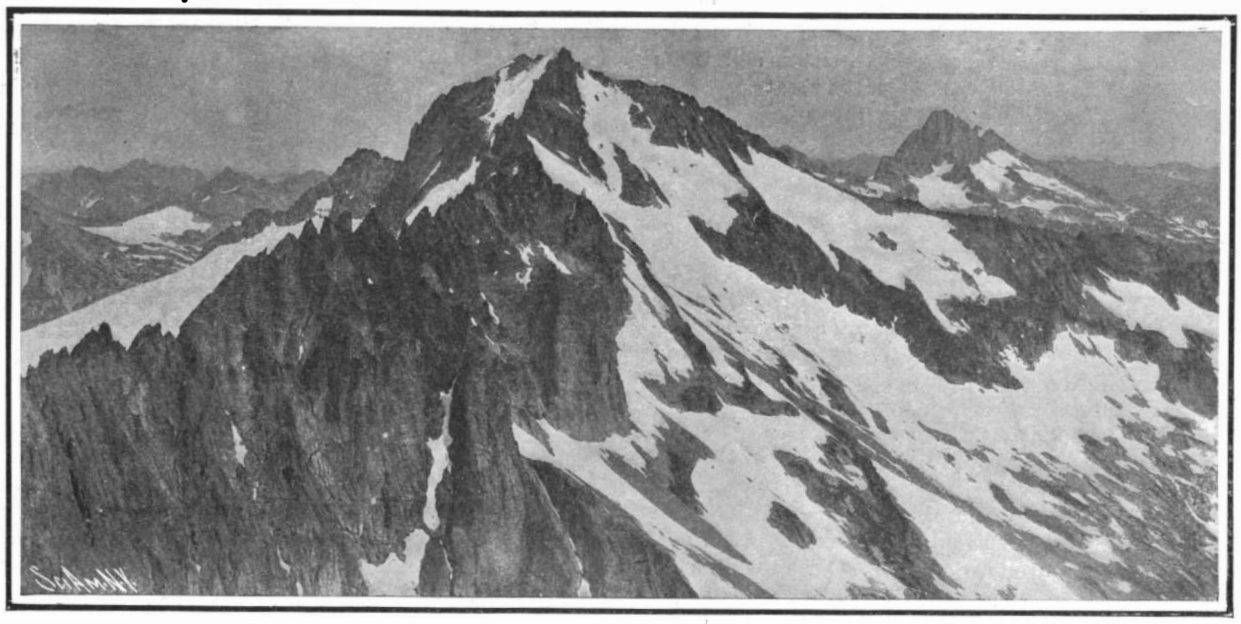
Dr. and Mrs. Workman and Their Guides 20,751 Feet Above the Sea.



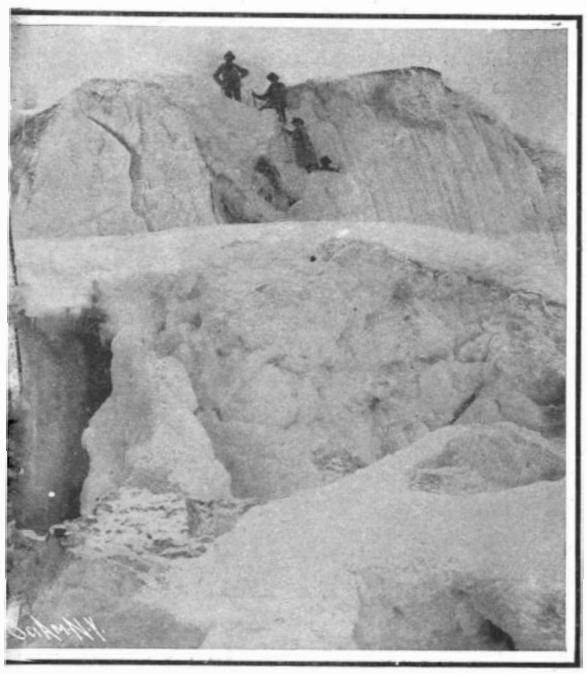
The Handicap of Climbing; An Outdoor Kitchen.



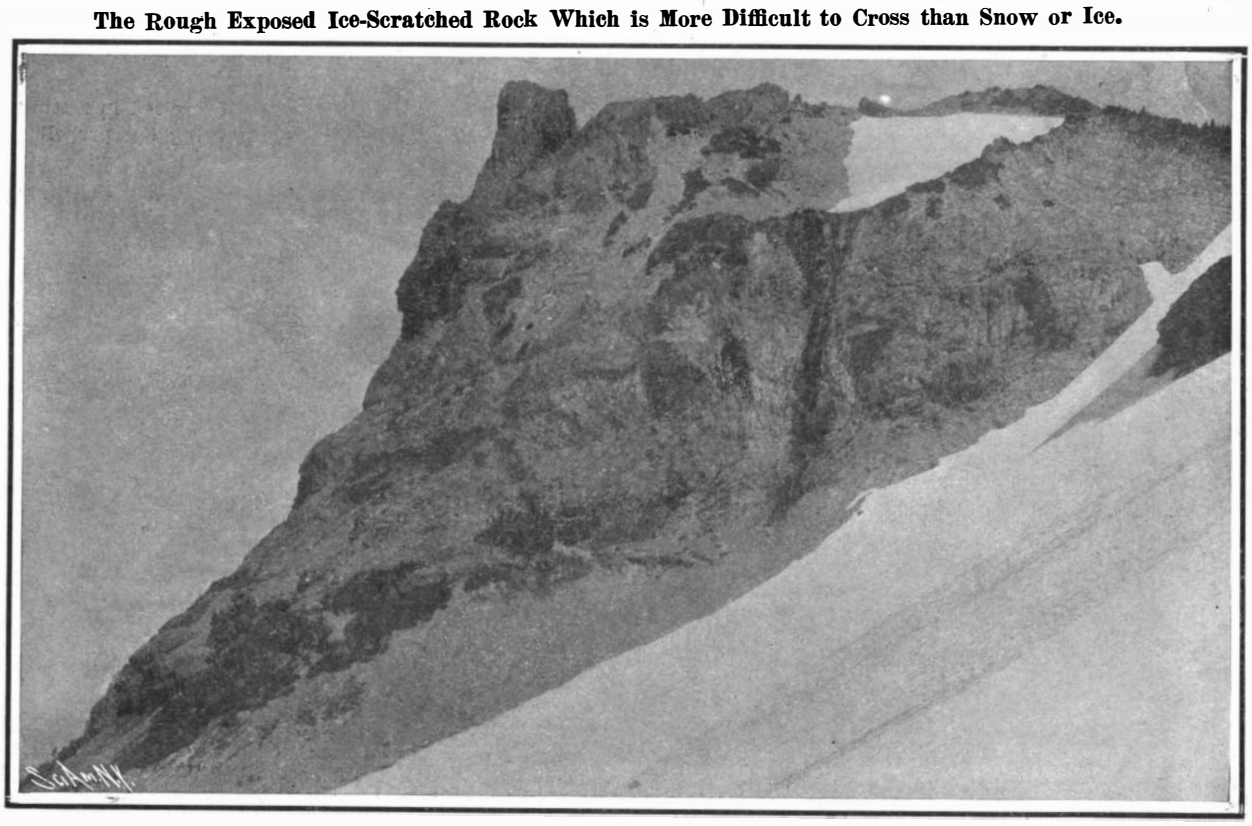
In the Edge of a Glacier 14,000 Feet Above the Sea.



The Rough Exposed Ice-Scratched Rock Which is More Difficult to Cross than Snow or Ice.



The Surface of a Glacier Is Not a Smooth Sea of Ice.



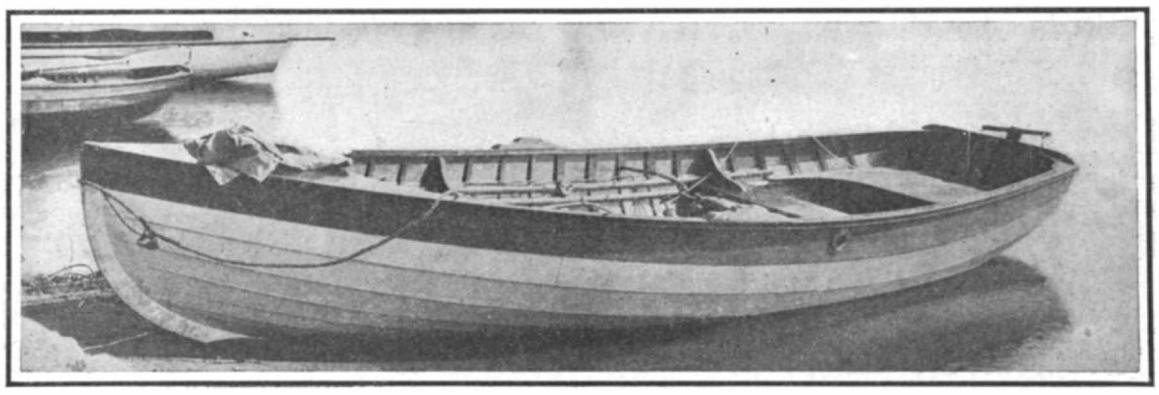
At Places Above the Snow Line Bold Crags Often Outcrop from the White Covering.

MOUNTAINEERING IN THE HIMALAYAS.

MOTOR BOATING FOR THE MAN OF SMALL MEANS.

BY HARRY WILKIN PERRY.

Never before has the man of small means been able to so readily avail himself of the recreations indulged in by his wealthy neighbor as to-day. This condition has been brought about wholly by mechanical development and applies to many forms of sport. It is only necessary to recall how very quickly the improved methods of manufacture brought the cost of bicycles down from $150 to $50 and even $15 for the cheapest machines, to see how the man on a small salary was given the benefit of "mass production" by the development of automatic machinery. In much the same way the pleasures of automobiling and motor boating are to-day being rapidly brought within the reach of persons of small means. It is possible now for anyone who is able to spare $250 or $325 to become the owner of a complete automobile capable of carrying two adults and a small amount of luggage over ordinary country roads at far better speed than a horse can do the work, while the delights of fast motion on the water without physical exertion can be indulged in with an outlay of only one-third to one-half these sums.



A Light and Speedy Motor-Driven Yacht Tender. Weight, 300 Pounds; Horse-Power, 1½; Speed, About 10 Miles.

We have become so accustomed to thinking of automobiling and motor boating as the sports of the rich that it comes as a distinct surprise to learn that it is possible to buy complete motor boats of full size for less than $100; good, serviceable motor canoes that will carry two or three persons and their luggage over river and lake at eight to ten miles an hour for $125; a complete outfit of engine, propeller, batteries, and tanks for quickly converting a skiff or rowboat or small sailboat into a power craft at a cost of $50; and a small engine to be permanently installed in a hull for the low price of $43.75.

The man who already owns a small rowboat, dory, or skiff can become the possessor of a motor boat at about half the outlay of the one who has to purchase the hull as well as the engine and propelling mechanism. Conversion of such a craft into a power boat is made simple and inexpensive by means of a so-called "outboard" outfit, which is a complete power unit, that can be attached to the stern post of almost any small boat by tightening with a wrench three bolts in two stout metal clamps that grip the upper and lower ends of the post. No alteration in the boat is necessary and no other tool than a small wrench is required. The outfit can be removed easily and packed in the box in which it is shipped. This same outfit can be attached to sailing vessels up to five tons displacement and used as an auxiliary to drive the boat home in event of being becalmed.

Such an outfit, which was first brought out in France a couple of years ago under the name of "motogodille" and was illustrated at the time in our columns, is made by the Waterman Marine Motor Company, of Detroit. It comprises not only the motor and propeller, but the steering apparatus as well. Under the best conditions it is capable of driving an 18-foot rowboat at a rate of seven miles an hour. To the upper end of the upright column that is clamped to the sternpost is secured a single-cylinder, two-cycle, water-cooled engine. This has a cylinder of 2¾ inches diameter and 3-inch stroke of piston, and at 750 revolutions per minute it develops 2 horse-power. By means of bevel gears and a vertical shaft turning inside the upright column, the engine drives a two-bladed propeller of 11 inches diameter, turning it 500 revolutions to the 750 of the motor. A submerged plunger pump located on the bottom bracket forward of the propeller supplies cooling water to the water jacket. A cylindrical fuel supply tank for the gasoline is carried on top of a wood tiller that extends forward over the rear of the boat. By means of this tiller the position of the propeller is altered to change the direction of the boat, thereby obviating the need of a rudder. Ignition current is provided by four cells of dry battery and a spark coil carried in any convenient place within the boat. The engine is started by means of a detachable crank that can be applied at the top of the driving shaft, which extends beyond the top of the upright column for this purpose. Carbureter and lubricator are attached directly to the motor, which exhausts through a muffler at the back. The circulating water is discharged from the top of the water jacket through a downwardly curved pipe. Such an outfit, complete with muffler, can be bought for $50. A similar device, in which an electric motor, run by storage batteries carried in the boat, furnishes the propulsive power, has been on the market for a number of years.

During the last two years the motor canoe has come into considerable prominence among small power craft, the extreme lightness, grace, and strength of the Indian model in combination with a light, inexpensive motor making it appeal particularly to campers who often have to carry their craft around some shoal or other obstruction, and to those who spend their vacations on the shores of small lakes and streams that are comparatively shallow. The submerged propeller, however, increases the customary four-inch draft of the canoe to from twelve to fifteen inches at the stern, so that deeper water, as well as freedom from weeds, is required for the power canoe than for the one that is propelled by paddles.

An American Adaptation of the "Motogodille"—A Combination of Motor, Tiller, and Propeller That Can Be Quickly Attached to Any Small Boat.

The American form of this device is more compact and has a water-cooled two-cycle motor in place of the small air-cooled four-cycle engine used on the French apparatus.

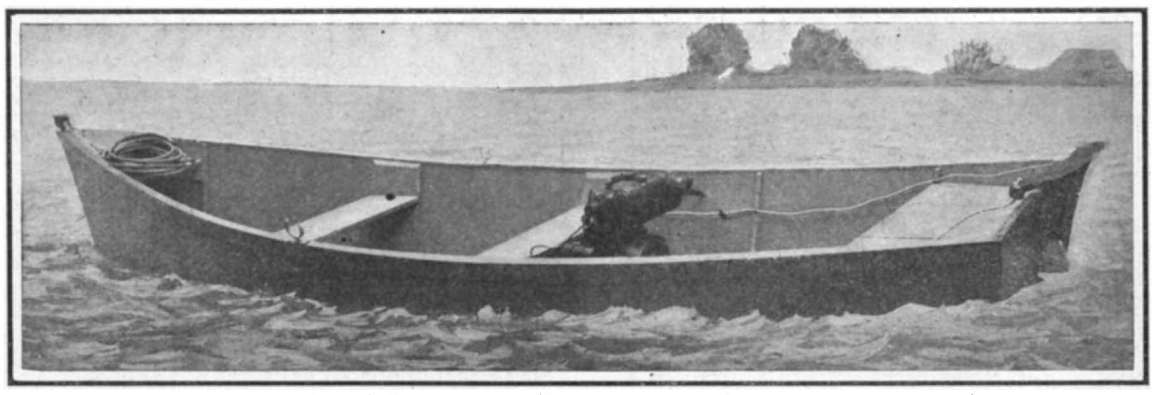
(a) An extremely compact and neat little engine weighing only 36 pounds has been especially designed for installation in Indian canoes. This engine and the outfit that accompanies it are intended as permanent equipment and are not in any sense an attachment. Considerable care has to be exercised in setting up the motor, and especially in putting the propeller shaft in at the correct angle, lining it up with the crankshaft, and making a strong, watertight job. The outfit includes a stuffing box for the shaft to turn in, and an 11-inch two-bladed propeller. The engine is of the single-cylinder, two-cycle, three-port type and develops 2 horse-power. It will turn the propeller 1,000 revolutions per minute, which is sufficient to drive a canoe from ten to fourteen miles an hour, according to the lines of the craft.

Although designed primarily as a special canoe motor and particularly for use by persons who have never tried to run a gasoline motor of any kind, this little engine is being installed in yacht tenders of the smallest size in dories, and in yawls, and it is even used to drive bilge pumps in yachts. It has a gray iron cylinder fitted with a copper water jacket and mounted on an aluminium base. Crankshaft and connecting rod are of steel and the bearings are bronze bushed. The water pump and all fittings are of brass and the carbureter is of the float-feed type. A canoe fitted with this outfit complete was exhibited at the Motor Boat Show in New York city last December. The total weight was given as 101 pounds—easily carried by two men—while the speed was ten miles an hour, and the price $125.

(b) A more ambitious canoe, especially built throughout for power propulsion, combining strength with large carrying capacity and seaworthiness, has a length of 20 feet, extreme beam of 46 inches, and weighs, complete with power equipment and crated for shipment, 750 pounds. It has a 23½-inch pointed bow and torpedo stern, with turtle-back deck and coaming around the edge of the cockpit. Sponson air chambers extend from stem to stern outside of the gunwales to prevent capsizing, thus making a safe craft capable of a speed of ten miles an hour. The regular equipment includes a 2-horse-power engine, although a 3-horse-power engine will be installed for an extra charge of $25. The regular model can be bought for $175 net.

(c) Probably the lowest price at which a complete motor boat, ready to run, can be bought is $85, with a discount of 15 per cent for cash, bringing the net price down to $72.25, free of bills at the factory. It is taken for granted that the man who is looking for a motor boat at any such price is not in search of a fast pleasure craft, so he is offered a rough and ready fishing boat that can also be used for pleasure boating on shallow waters or as a tender to larger craft. It has the lines of the flat-bottom, straight-sided rowboat that is so familiar at summer resorts and in the park lagoons. The bow is straight, while the stern is square and fitted with a broad seat. Other flat board seats form thwarts. The dimensions are 14 feet over all; 4 feet 2 inches beam; draft, 2 inches at stem and 12 inches at stern; total weight, 365 pounds. The boat will accommodate six persons. An 80-pound motor of 1⅜ horse-power is installed, and a 10-inch bronze propeller is fitted. The engine has an extreme height of 19 inches, extreme width of 12 inches, and depth of 16 inches. It has a forged steel crankshaft and steel wristpin, phosphor-bronze connecting rod and shaft bearings, a positive diaphragm pump with no operating parts except check valves and requiring no power from the engine, make-and-break ignition, simple float-feed carbureter having no valves to get out of order, and a throttle for regulating the engine speed and maintaining it anywhere from 900 revolutions per minute to a full stop. The engine is started by pulling a cord that is wound around a pulley on the main shaft just aft of the flywheel. While this motor boat is the cheapest built, the company which makes it also manufactures a special line of low-priced power dories and skiffs that are better adapted for work in open water and of course are faster and better boats.

(d) The boats which approach the nearest in price to the boat just described are the open, round-bottom, square-stern power boats that sell for approximately $95. Several builders are offering these, notable among them being the Detroit Boat Company, which offers one at $94.50 net. This is a regular "planked" boat with smooth sides—not a lap strake, clinker built or carvel boat with overlapping side strakes. The dimensions are 14 feet over-all length, 4 feet 2 inches beam, 17 inches depth amidships, and 13 inches draft. Oak frames and cypress planking are employed, which make this boat substantial and seaworthy. It is especially adapted for use on small lakes and rivers. It seats five persons and has an approximate speed of six and one-half miles an hour. The net weight, with



Rowboat Fitted With a 1 3-8-Horse-Power Motor. This Boat is the Cheapest Type on the Market.

DIFFERENT TYPES OF LIGHT, CHEAP, AND SPEEDY POWER BOATS.

engine, is 450 pounds. A 2-horse-power reversible Detroit engine is installed.

(e) Listing at $96 comes a motor boat with steel hull. So far as size and form go, it is similar to the boat just described, but the hull is made of strips of steel riveted together, lapped and seamed in such a way that the seams give great strength and rigidity to the hull and make it positively watertight. Such a hull is practically indestructible, and as the steel strips are galvanized and the hull painted with pegamoid waterproof paint, the boat is non-rustable and can be exposed to all sorts of weather and left in salt water without harm. Since the hull cannot absorb water, the boat always retains its original buoyancy.

(f) The same company has brought out for the season of 1908 a 16-foot launch fitted with a 3-horse-power motor, to sell for $145 net. This is designed as a family pleasure boat, having a comfortable carrying capacity of eight or ten persons, and being capable of a speed of nine to ten miles an hour. The draft is only about 12 to 14 inches, making the boat particularly adapted to shallow water. The hull is of steel, with lock seams, and is equipped with steering wheel, flag-pole sockets, flag poles, ensign, and burgee. The engine is of the two-cycle, reversible type, having a damper controlling the automatic accelerator on the carbureter. It has a rapid water-circulating pump, water-jacketed exhaust chamber, and muffler, while the propeller shaft carries a three-bladed bronze speed propeller.

(g) Power yacht tenders are much in demand and are built as regular models by the larger motor boat building works. Good examples of these are the 12 and 14 foot tenders like that shown on the opposite page. These little boats are fitted with 1½-horse-power engines, which propel them at a good speed. They sell at from $140 to $175, according to size and finish. The weight is between 250 and 300 pounds and they are easily hoisted at the davits or will tow astern and keep dry in a seaway. They have a beam of 4 feet and can make from six to seven miles an hour. They are constructed with frames of white oak planked with pine, cedar, spruce, or cypress, in single lengths, eight strakes to a side, and capped or lapped three-quarters of an inch. The fastening throughout is copper and brass. Each tender is equipped with a pair of spruce oars. The engines have an under-water exhaust.

(h) If the prospective buyer of a small power boat feels able and willing to pay $200 for a pleasure craft, he has a choice of a number of distinctive looking and well constructed launches with comfortable seating capacity for from four to six persons and a speed ability of eight miles an hour. A sample of these is a 17½-foot launch, fitted with a single-cylinder, 2-horse-power, two-cycle motor. This is in no sense a rowboat, with a lap strake construction, but is especially built on launch lines with smoothly planked sides, turtle-decked bow, V-shaped vertical stern, and coaming around cockpit. It has a beam of 4 feet. The planking is of ⅝-inch red cypress, ribs and all framework of second-growth white oak, and bow and stern decks of solid mahogany. The seams are carefully calked and the outside is given three coats of paint. The engine has a bore and stroke of 3½ by 3 inches and is claimed to develop 2 horse-power at 500 revolutions per minute and 3 horse-power at 900 revolutions per minute. Persons who own row boats, skiffs, dories, and small sailing craft are enabled to convert them into power boats at very small expense by installing the extremely low-priced motors offered in the market. Makers of marine motors are legion, and there are many small single-cylinder, two-cycle motors that can be bought for $50 or less.

(i) A new type of motor-boat engine which has recently made its appearance is the light-weight, multiple-cylinder engine of low horse-power, for use in small boats. These engines are generally of the two-cycle type, the cylinders being fitted with individual vaporizers as a rule. One of the three-cylinder engines of this type now on the market develops 6 horse-power and weighs but 170 pounds, or, if an aluminium base is used, 155 pounds. In this instance but a single carbureter is employed. Compression grease cups are used on the bearings, and sight feed oilers on each cylinder. The oil which lubricates the pistons afterward is carried down to the crank case and made to oil the crank-pin bearing. The connecting rods are of bronze with adjustable hinged boxes at the lower ends. This engine can be depended upon to swing a 16-inch, 2-blade, 24-pitch propeller at from 850 to 900 revolutions per minute. This type of motor offers a distinct advantage over the usual single-cylinder engine in that the vibration is reduced to a minimum and that the engine, in case of the failure of any one cylinder, can still be operated on the others—a feature that is very desirable in a small motor boat. Engines of this type and horse-power cost about $175.

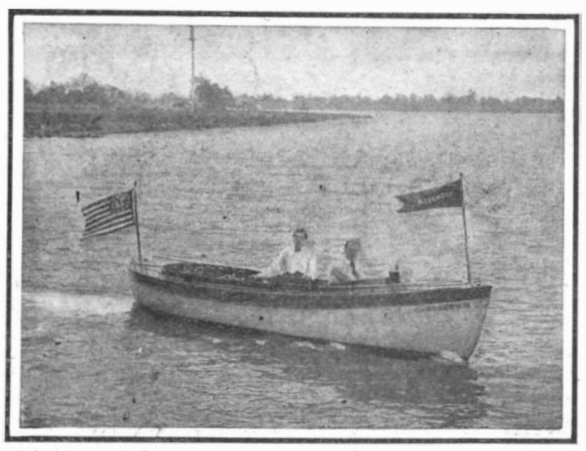
Another new type of marine engine which has lately been placed upon the market is shown in the cross-sectional diagram. This engine is known as the Twice Two-Cycle, and it is in some measure a return to a very old form of construction employed by Clerk and Kortig. There are two cylinders—a working cylinder and a compressing cylinder. The working cylinder only is water-jacketed. There are but three mechanically-operated valves to the two cylinders, and these are worked from cams on the crankshaft, which does away with the usual camshaft of a four-cycle engine, and the consequent play that often develops in the two-to-one gears. A fresh charge is drawn into the compressing cylinder and compressed therein at each revolution while the piston of the other cylinder is on its working and exhaust stroke. As soon as the burned gases are driven out through the exhaust valve, the fresh charge under compression in the adjoining cylinder passes out through the mechanically-opened exhaust valve of said cylinder, and into the working cylinder through an automatic inlet valve. It is then fired in the regular manner. The chief advantage obtained by this construction is the complete scavenging of the working cylinder and the filling of it with an undiluted, relatively cool, compressed charge at every revolution of the crankshaft. This makes possible the use of a higher compression, and the single operating cylinder working as a two-cycle engine is considerably more efficient than an ordinary single-cylinder two-cycle motor of the same bore and stroke.

While the boats and engines here described and illustrated do not include all of the products selling at prices as low as those given, they have been selected with a view to presenting typical examples of what a man of moderate means is now able to get for a very small outlay that will enable him to enjoy the pleasures of motor boating as well as his more fortunately situated neighbor.

If any of our readers wish further information as to the makers of the various craft and motors described above, we shall be glad to furnish this upon application to us.

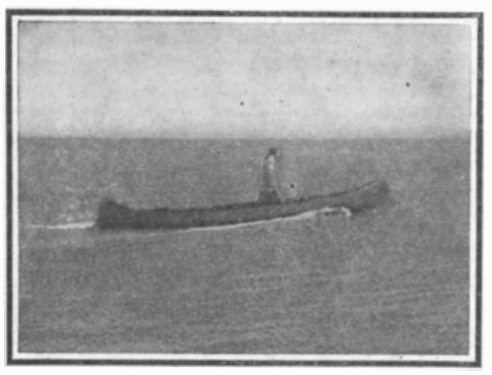
Twenty-Foot Power Canoe Fitted With Sponson Air Chambers.

This canoe weighs but 750 pounds. Fitted with a 2 or 3-horse-power engine it will make 10 miles an hour or more.



A Popular Type, 16-Foot Launch Having a Steel Hull and 3 Horse-Power Motor.

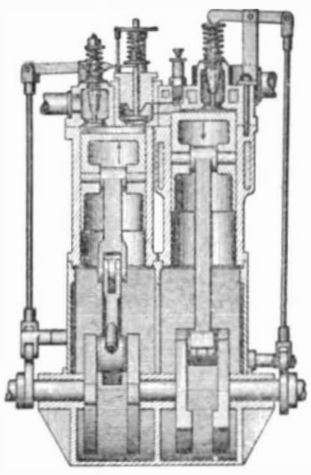
This is a comfortable family pleasure boat. Its shallow draft makes it adaptable to rivers and shallow streams.



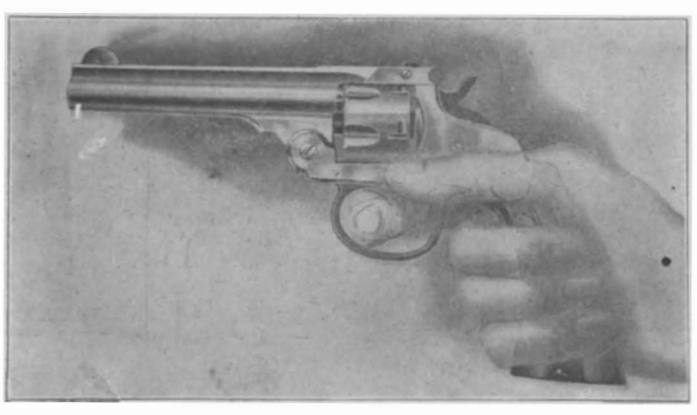
The Indian's Canoe Transformed Into a Motor Boat.

This represents the latest application of the gasoline motor to a light craft. Total weight, 101 pounds; speed, 10 miles an hour.

DIFFERENT TYPES OF LIGHT, CHEAP, AND SPEEDY POWER BOATS.



CROSS-SECTIONAL DIAGRAM OF THE TWICE-TWO-CYCLE ENGINE.



AN IMPROVED GRIP FOR REVOLVERS.

A NEW TARGET GRIP.

When one sees a modern revolver beside an ancient fire-lock pistol, or a somewhat later flint-lock, it is hard to realize that the very nearly perfect arm of today is the lineal descendant of such ancestors. Crude in design, the workmanship often displays a rare degree of skill and artistic feeling; they seem to us to be better adapted for use as clubs than as firearms.

The change from the past to the present is particularly marked in the Harrington & Richardson target grip, attachable to several of their revolvers. By it the handle or stock of an ordinary pocket weapon is converted into the long grip with powerful leverage so essential in a target or belt arm, where the tremendous aid to accurate shooting so obtained is not discounted by the increased size.

The two shells of the new grip, made of hard, checkered rubber, fit over the frame, and are made a substantial part of the revolver by the clamping action of the two long screws.

A Correspondence School of Aeronautics.

In view of the intense interest in aeronautics recently aroused in America, all those interested in the new science will be glad to learn of the establishment of a correspondence school covering all branches of the subject. This new school is being conducted by Mr. Albert C. Triaca, who formerly had charge of the foreign department of the New York School of Automobile Engineers. Mr. Triaca is a licensed pilot of the Aero Club of France, and for the past year he has made a thorough study of the construction and management of balloons, aeroplanes, and aeronautical motors. He has been located in Paris and thus has been able to follow personally the tremendous advance in the science of aeronautics which has been made in France during this period. As a result of this, the new course is doubtless the most complete and authentic exposition of aeronautic matters that has as yet been made. The course consists of lessons arranged for home study and illustrated by nearly 300 diagrams and charts prepared by Lieut. Col. Espitallier, the foremost of the aeronautic experts of the French army. There is a permanent technical staff on aerostation and aviation, consisting of such well-known men as Georges Besancon, Maurice Mallet, Victor Tatin, Capt. Ferber, and Levavasseur, the inventor of the light-weight Antoinette motor. The collaboration of these men has resulted in the production of papers giving in full detail the work that has been done, the methods of the most successful aeronauts and aviators, and the details of construction of balloons, dirigibles, aeroplanes, helicopters, orthopters, and all other forms of apparatus. Many scientific data, formulæ, and tables are given, and there is a great deal of information that is unobtainable elsewhere.

There are three courses, namely, (a) spherical balloons; (b) dirigibles; (c) heavier-than-air machines. The student will be supplied with information regarding any new machines that are produced, and thus will be kept in touch with the constant advance being made in the new science.

(*Continued on page* 152.)

THE NEW SYRACUSE UNIVERSITY STADIUM—THE FINEST ATHLETIC ARENA IN AMERICA.

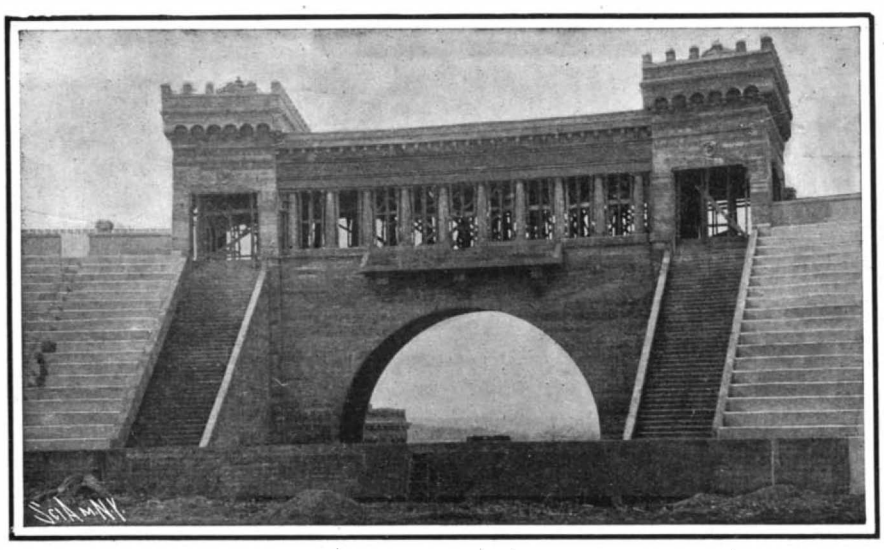
The importance of athletic sports in ancient times is attested by the magnificent structures erected by the Greeks and Romans to accommodate the spectators of the games and races. The oldest are the Greek stadia (so named from the stadium, a measure of length equaling 606 feet 9 inches) originally simply natural hollows. Later the contours were made more regular, seats were provided, resting directly on the ground, and still later, where a convenient slope was lacking, as at Delphi and Messene, the seats were elevated on a masonry substructure.

The stadium at Athens, recently noted through the revival of the Olympic games there, is a type. It was probably constructed by Lycurgus about 350 B. C. In the second century Herodes Atticus, a wealthy Roman, added seats of Pentelicon marble. Like all Greek stadia, it is horseshoe shaped, narrow and long (the arena is 669 feet by 109 feet) and seated 50,000 spectators.

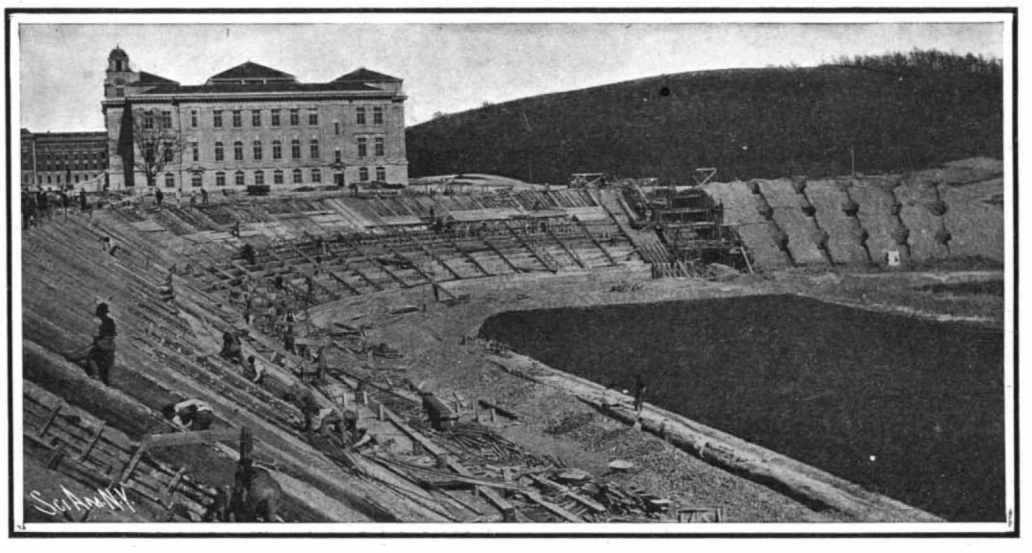
The Romans developed the stadium along two lines. The circus, for chariot and horse racing, was similar in design to the Greek stadium, but comparatively wider and much larger. Down the center was a narrow central wall, the spina, dividing the arena. The most noted of these was the Circus Maximus at Rome, about 700 feet by 2,200 feet, and seating nearly 400,000 spectators. Our modern race track is a feeble imitation.

The amphitheater was designed for gladiatorial and similar contests, formed a complete ellipse, and like the circus was generally erected on arches and vaults of massive masonry. The Colosseum at Rome is the most noted of the amphitheaters, but those at Nimes and Arles in Provence are better preserved.

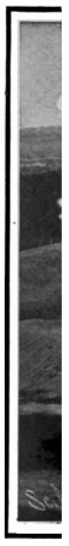
The modern renaissance in athletics has stimulated the erection of increasingly magnificent arenas. Safety, convenience, and beauty are the prime desiderata—all found in reinforced concrete. The most important concrete arena built previously to the one at Syracuse was the Soldiers' Field at Harvard. The latest and finest in America, approximating most nearly the ancient Greek model, is the one just completed at Syracuse by the Consolidated Engineering and Construction Company of New York,



The Grand Entrance, Viewed From the Arena.



A Section of the Stadium, Showing in Foreground Forms for the Concreting.



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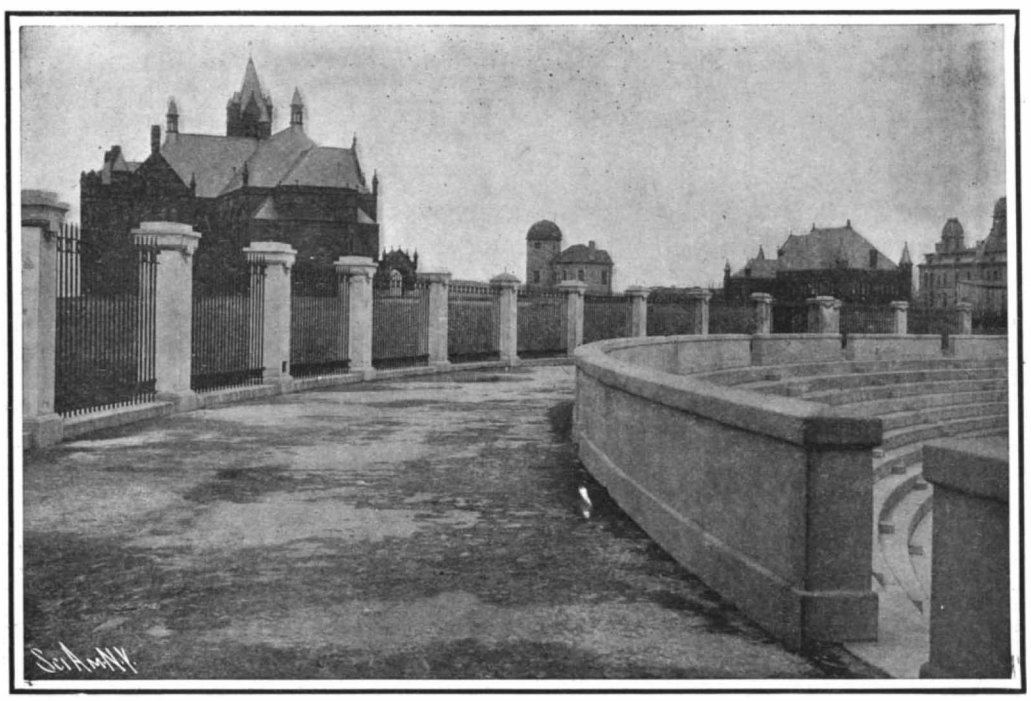
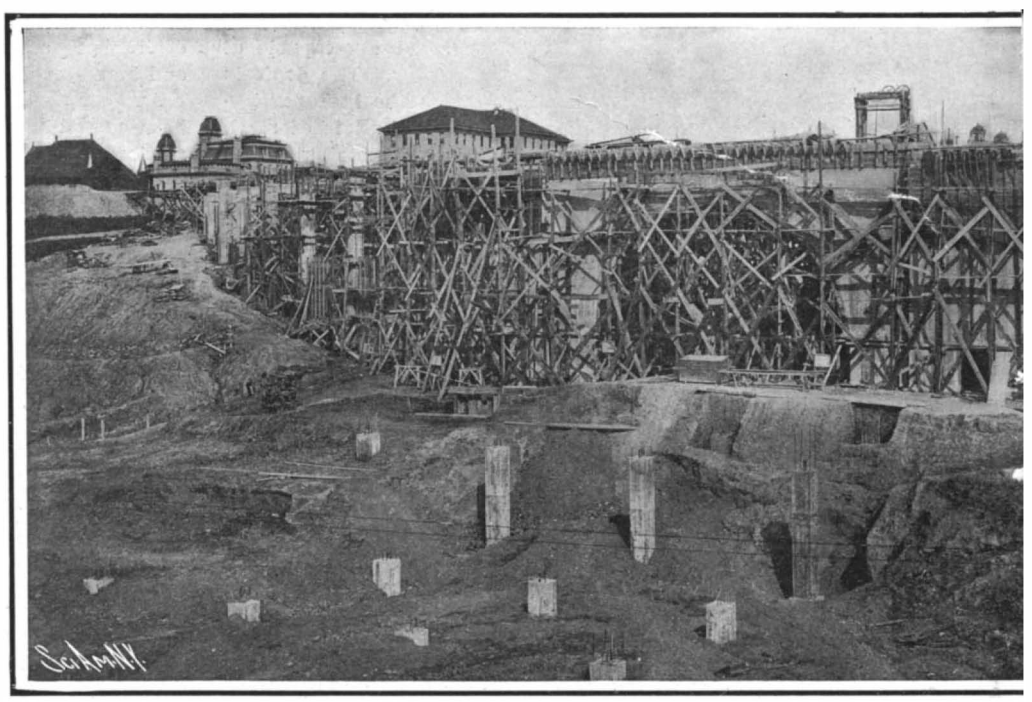
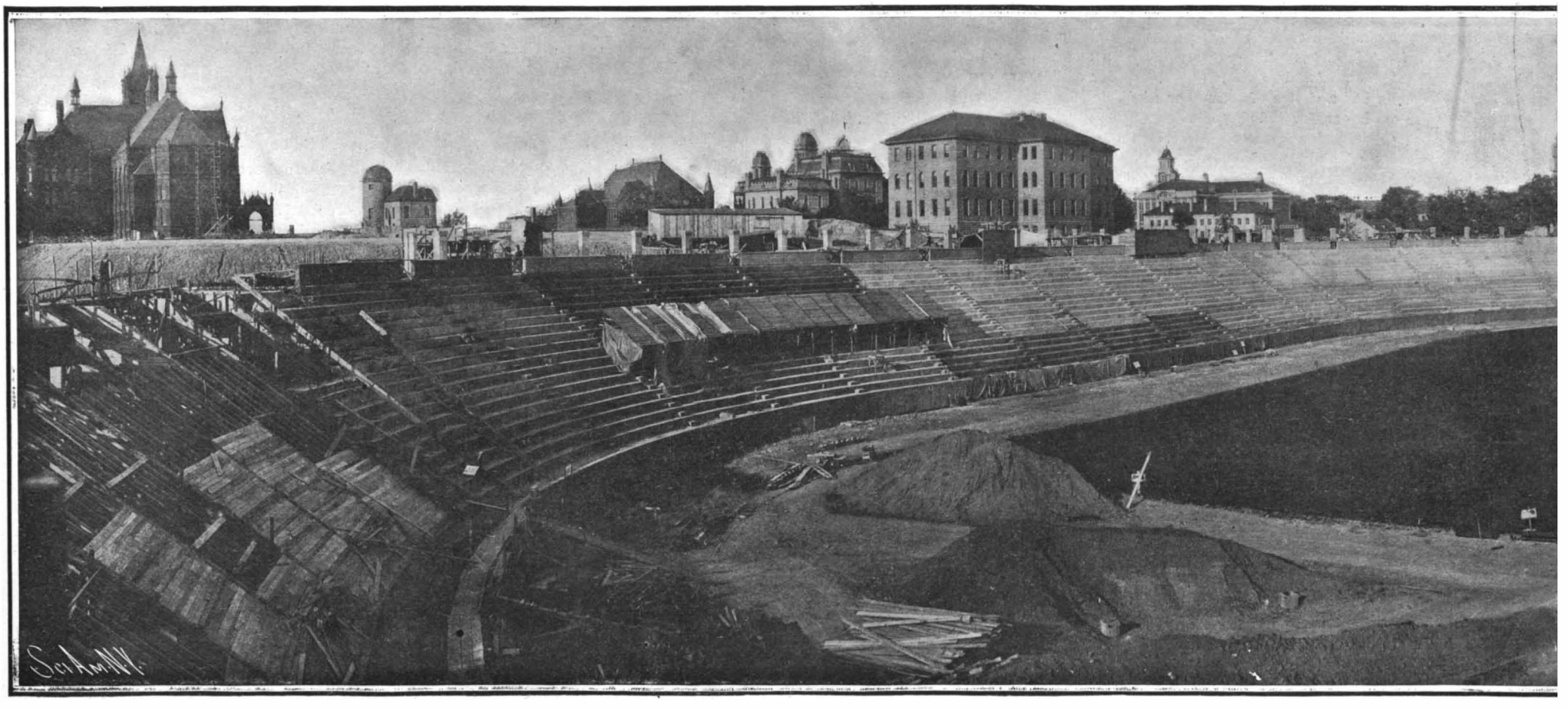


Portion of the Broad Concourse Around the Crest of the Arena.



Construction of the Concrete Wall and Arc



General View of the Huge Stadiu

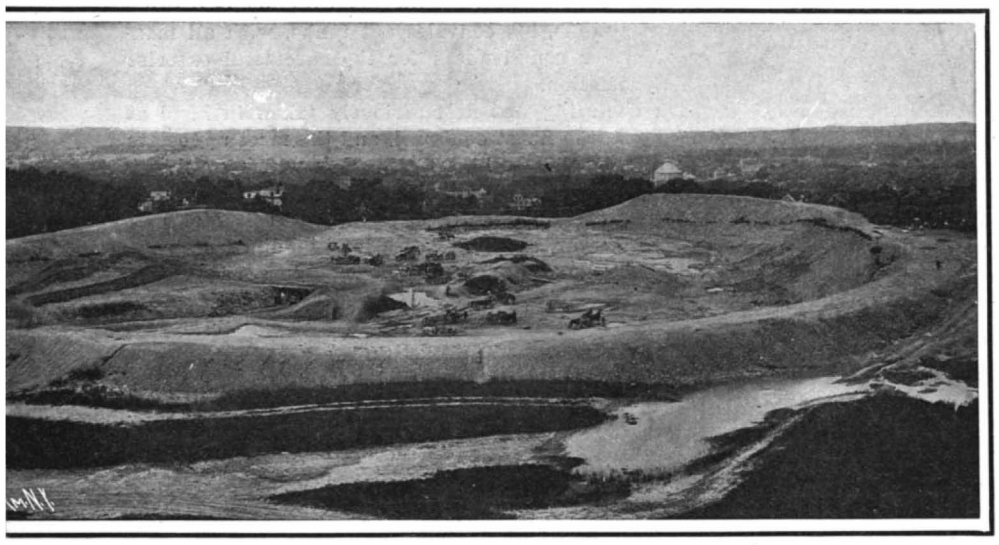
THE NEW SYRACUSE U

rough whose courtesy the facts here given were obtained. The natural situation is peculiarly felicitous on an elevaon with a magnificent outlook over the city of Syracuse d Onondaga Lake in the distance. The structure is ique among American stadia in that the arena and surunding seats are below the level of the ground. In neral outline the stadium consists of two semicircular ds joined by straight sides; its dimensions are 670 feet 475 feet, and it will accommodate about 40,000 spectors. The field is sodded, with an elaborate system of bsoil drainage. Outside that is a ¼-mile cinder track, d on one side is a 220-yard straight-away course which sses out of the arena through tunnels at either end.

As in the old stadia, the first tier of seats is elevated five feet above the arena with a walk between them and a protecting curb. There are eighteen tiers of seats, 18 inches high and 27 inches wide. At the top is a breast-high concrete wall which forms a protection for a 20-foot concourse entirely encircling the Stadium. As this is on the outer ground level it can park hundreds of automobiles, whose occupants can watch the game and the crowd beneath them. This concourse is in turn guarded by a concrete curb and ornamental pylons 18 feet apart with a heavy iron fence. These pylons at regular intervals are equipped for arc lights, the others with sockets for standards.

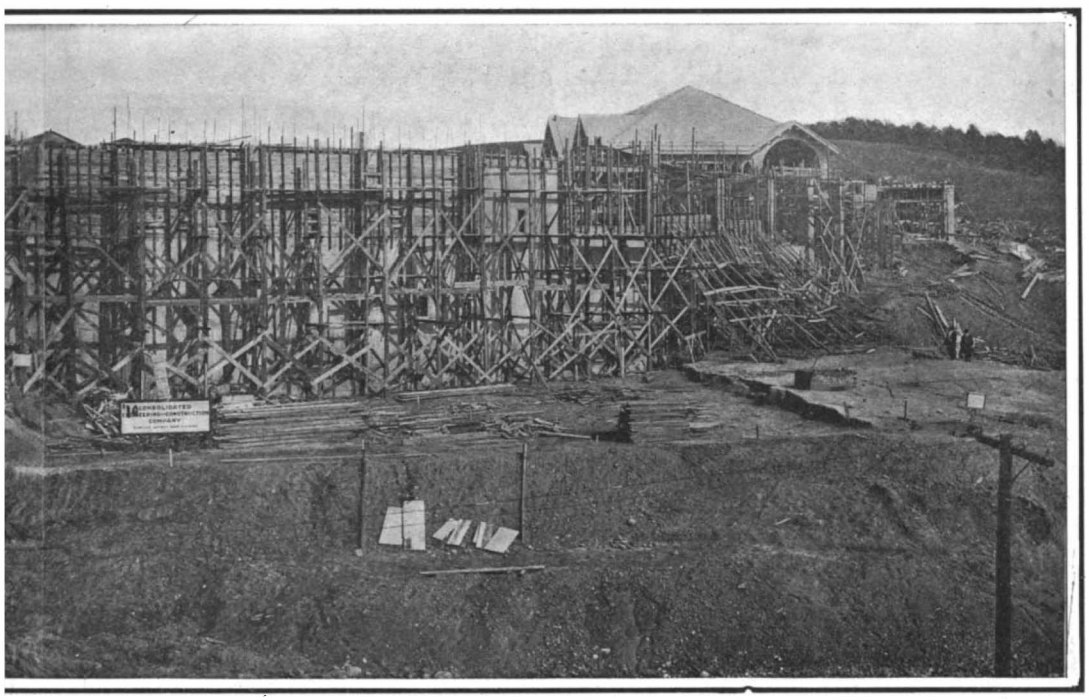
On the west end the ground falls away suddenly toward the valley. Here the stadium becomes a 35-foot structure with buttresses and curtain walls of reinforced concrete. Here is the imposing main entrance, a 40-foot arch, flanked by tall towers and led up to by broad flights of steps. The towers contain ticket and athletic offices, etc., and on either side are stairs by which the incoming crowd may reach the concourse and distribute itself over the entire stadium.

On the south side is a covered grand-stand, 196 feet long, covered with a cement roof and supported by a concrete-covered steel truss shell in a semi-Gothic style of architecture. The roof is reinforced with ferrolithic plates, consisting of steel sheets, gage No. 24, with two sets of dovetail corrugations (¾-inch and ⅛-inch respectively) at right angles. These sheets were attached by clips to

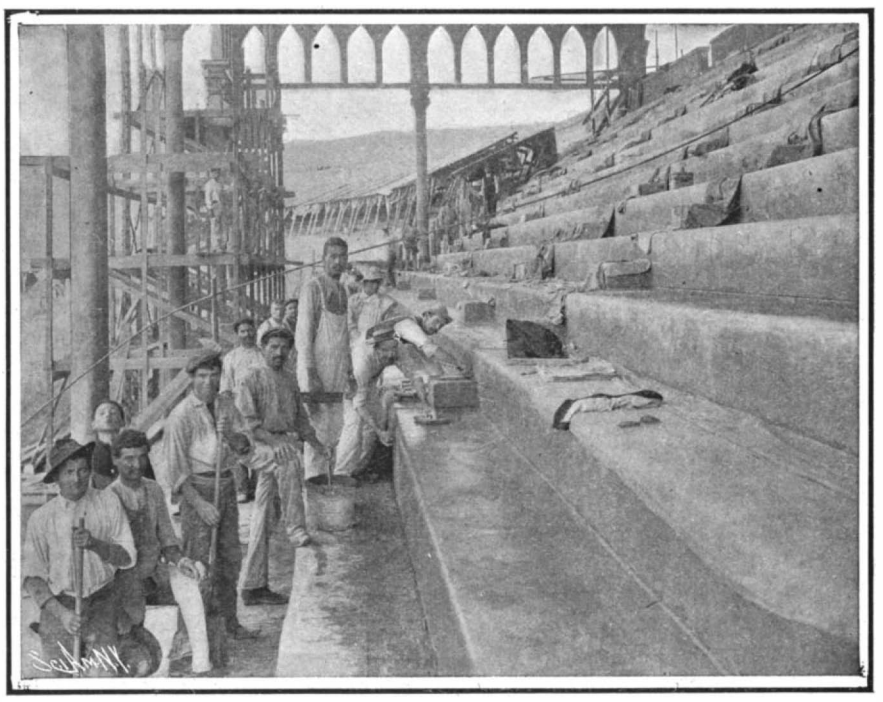


Great Artificial Basin Upon the Embankment of Which the Concrete Seats Were Built.

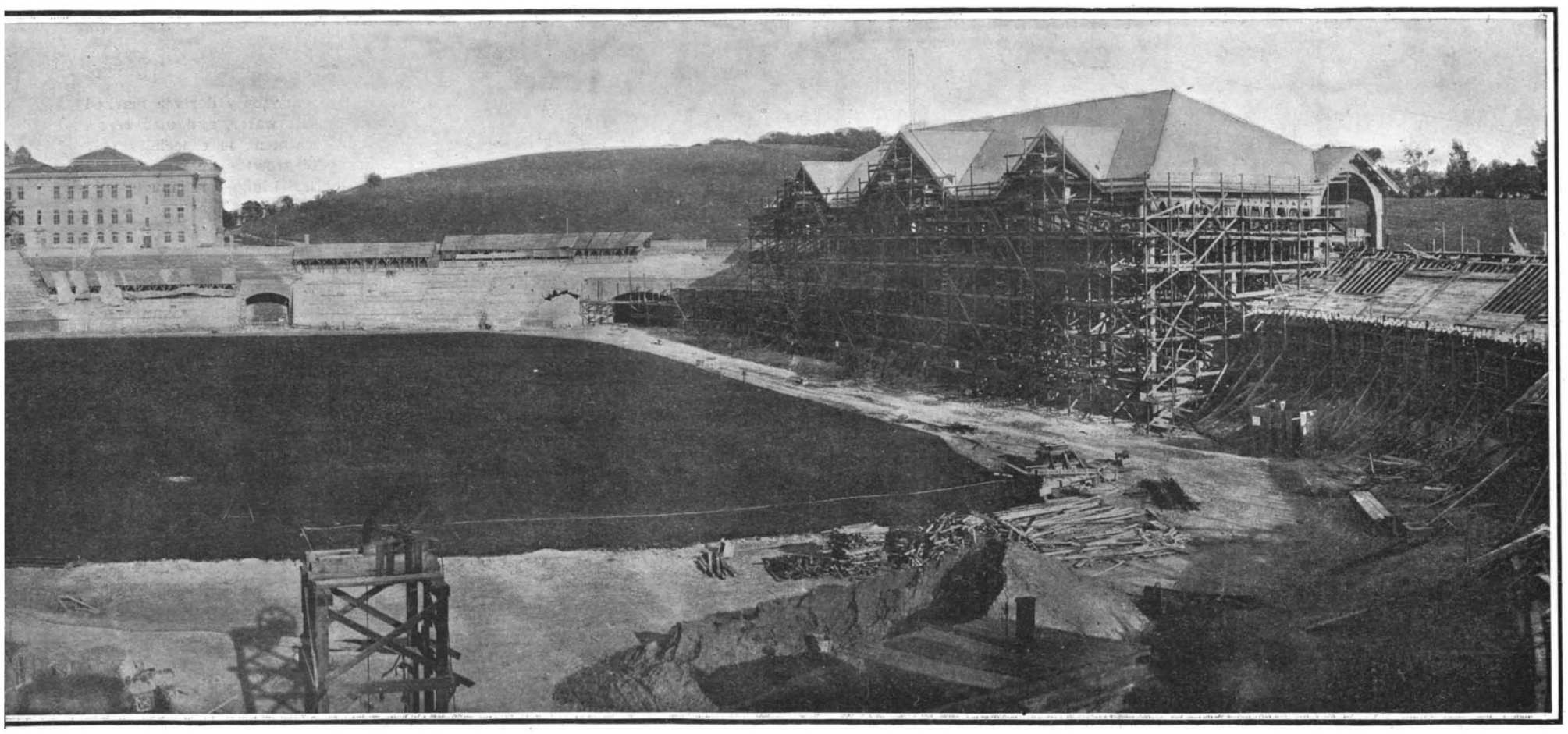
The Embankment Ready for the Laying of the Concrete Steps.



h Through Which Access is Had to the Stadium.



Putting the Finished Surface on the Seats in the Grand Stand.



m of Syracuse University.

NIVERSITY STADIUM.

the purlins, the latter 6-inch I-beams about 6 feet 10 inches apart. The dove-tailed corrugations gave sufficient bonding surface, and the sheets were strong enough to sustain the weight of the concrete without forms. For the small ornamental arches, light furred steel angles covered with metal lath were used. Within the columns are 4-inch pipes to carry off the roof water.

Generally speaking, the stadium is supported by piers, five in a row, in lines about 15 feet apart on the sides and at distances of 40 deg. 30 min. on the curving ends. These piers go down to the original soil, which necessitated in some cases, where a considerable fill had been made, a 25-foot or more well. The ground varied—hardpan, sand, loam, and gravel.

The contractors say:

"It was assumed that 600 pounds per square inch would constitute a safe load for columns reinforced with vertical rods and hooping, and 400 pounds per square inch for columns reinforced, but not hooped. These assumptions were, however, without importance, as other conditions governed the size of the columns. In general they were made of uniform size, of rectangular shape, 12 inches by 30 inches, reinforced with four Kahn bars, weighing 2.7 pounds per foot. The rectangular shape was adopted in order to resist the effect of any sliding tendency that the bank might have. Where it was necessary to use columns of great length, they were made square, with a side not less than 1/15 of the length of the column. These columns were reinforced with four round rods of ⅞ inch diameter, and wrapped with Clinton wire cloth 3 inches by 8 inches mesh, 8-10 wire. In general all parts of the structure were figured for a live load of 100 pounds per square foot, except the promenade, which was designed for 120 pounds, and the roofs over the grand stand and main entrance, which were figured for a live load of 40 pounds per square foot.

In calculating bending stresses, the straight line formula was used throughout, and the tensile strength of the concrete was neglected. It is of course realized that this formula is not scientifically correct, but in this respect it probably does not differ from any of the other formulæ at present in use.

The safe compression stress for concrete was in this case assumed to be 600 pounds per square inch and the safe tensile stress for steel 16,000 pounds per square inch. The girders, steps, and the slab of the promenade were figured continuous and the maximum bending moment was assumed to be $WL \div 12$ where W represents the total dead and live load and L the distance between supports. The negative bending moment over the supports was assumed to be $WL \div 18$ and steel was provided according to this assumption.

The main reinforcement for girders, steps and promenade consists of Kahn bars, with stirrups varying in length from 6 inches to 30 inches. In addition to the Kahn steel, Clinton wire cloth has been placed 1½ inches below the surface of all concrete exposed to view. This was done solely in order to prevent cracking, as much as possible, and the Clinton wire cloth was not taken into consideration when figuring the bearing capacity of the concrete. The sizes used were 4 inches by 6 inches mesh 10-10 wire, 30 inches wide, for the steps and 3 inches by 8 inches mesh, 8-10 wire, 72 inches wide, for other places.

One of the most serious problems in concrete construction, handled most successfully at Syracuse, is to prevent cracking because of contraction due to temperature or local changes. To obviate this some designers leave straight contraction joints at regular intervals. It was decided at Syracuse to use more reinforcing steel as being more sightly and cheaper in the end. It was estimated that steel to concrete in the proportion of 1/3 of 1 per cent would be sufficient to prevent cracking and this percentage was observed throughout. As further preventives all horizontal Kahn bars overlap 2 feet and Clinton wire cloth covers all exposed places.

Another problem was to secure a pleasant surface appearance, and here special pains were taken. The rough surface left by forms was out of question, however carefully worked. And plastering set concrete work usually fails because of the difficulty of securing a good bond. This was, however, accomplished at Syracuse by special and ingenious means. Wire nails were driven into the forms at frequent intervals. On removing the forms their pointed ends projected some 2 inches from the rough concrete. A small iron nut was slipped over each nail, the concrete was covered with wire lath, and the nails bent over with a hammer. The nuts thus kept the wire lath about ¼ inch from the old concrete. The plaster finish, averaging an inch thick, was put on in two coats, a scratch coat and a finishing coat of 1 part cement to 1¾ parts white Long Island beach sand. This was troweled smooth. This part of the work was protected from the sun by temporary wooden sheds; and during its hardening the finishing coat was covered with burlap and sand kept wet. The care taken justifies itself in a smoothness and beauty of finish remarkably effective.

The work was begun by the university directly and during some two years considerable excavating was done. The contractors, on taking over the work, installed an industrial railroad and completed the excavation and construction in about a year. The plain concrete for the work was cement, sand, and broken stone mixed in the proportions 1, 3, 5; the reinforced concrete in the proportions 1, 2, 4. The stone used was mostly limestone; the sand from a bed near the west end of the field, discovered in excavating. All mixing was mechanical, the plant consisting of five Ransome mixers with engines and boilers and a small Smithe auxiliary.

On the east end the field connects by tunnel with a new gymnasium, 150 feet by 220 feet, now being erected. This will also be perhaps the largest and finest in the world. A feature will be the pools; one, for swimming, of reinforced concrete lined with white tile, measures 32 feet by 90 feet.

The original idea of the stadium was Chancellor James R. Day's. The funds were provided by Mr. John D. Archbold, and the cost is already understood to have exceeded half a million dollars. The architects were Messrs. Revels & Hallenbeck, the heads of the Department of Architecture of the College of Fine Arts of the University.

The following facts may be of interest: Area covered, 6 1/3 acres; excavation, 250,000 cubic yards; reinforced concrete, 20,000 cubic yards; reinforcing steel used, 500 tons; Clinton wire cloth, 280,000 square feet; galvanized metal lath, 220,000 square feet.

FISH DOCTORING.

BY PETER COLEMAN.

Most people know that every large zoological collection has its hospital department for the treatment of sick beasts and birds, but few are aware that a similar institution is attached to a big aquarium. Such, however, is the case. Like all other captive creatures, fishes kept in tanks are liable to numberless hurts and ailments; and it has been found that a little timely treatment, either hygienic or surgical, will often suffice to revivify a sickly specimen. In the case of a rare fish, death would often prove a serious loss to the scientific world. So it has come about that the fish doctor is an important functionary at a big aquarium. He has his staff of assistants, his isolation tanks, his operating tanks, his convalescent tanks, with all manner of clever contrivances for the successful exercise of his profession.

Fish doctoring was first seriously taken in hand at the largest, the finest equipped, and the most up-to-date aquarium in the world, namely, that which overlooks the bay of New York, almost opposite the island crowned with the giant statue of Liberty. More recently, however, similar institutions in different parts of the world have followed the example set by America, for it is now generally realized that if fish are to be healthy, they must have individual care bestowed upon them over and above that given to the food with which they are supplied, and the temperature and purity of the water in which they swim.

Since the time when fish hospitals came into being, many interesting facts relating to fish hygiene have been established. For example, it is now known that a diseased fresh-water fish commonly derives marked benefit from a sojourn in salt water, and *vice versa*. This "change of water" treatment is especially successful as a cure for fungoid growths, to which many fishes—especially the smaller kinds—are much subject. The water to which sickly fresh-water fish are transferred is composed partly of water taken direct from the ocean, partly of river water. The result, of course, is a highly brackish solution; and this is kept at a slightly higher temperature than the water from which the invalid was taken. In like manner, an occasional bath of fresh water of the right temperature has been found very beneficial to sea fishes.

We have said that it is not enough to feed the fish regularly and systematically, and to cleanse their tanks periodically. The keepers must also be constantly on the watch lest their charges develop disease, or become damaged by fighting, or by collision with the glass walls of their tanks. A bruised specimen quickly develops the dreaded fungus disease, which not only disfigures and ultimately destroys the injured fish, but rapidly infests its companions in captivity. A plant parasite known as *Saprolegnia* is very destructive to fresh-water fishes; while other disfiguring growths are of constant occurrence, especially in the case of neglected tanks. As we have seen, a total change in the chemical character of the water is often very effective as a cure, while applications of formalin to the affected parts are said to be useful in mild cases. Fishes cannot, however, endure medicine, while the extreme delicacy of their skins renders even the handling of them exceedingly difficult.

At times, however, surgical operations become absolutely necessary, as in the case of a very bad growth

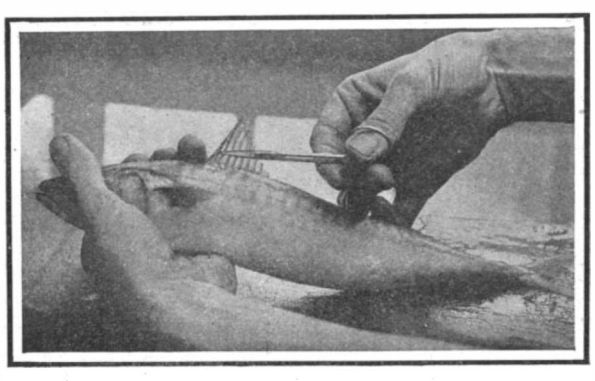
An Eel is a Difficult Fish to Handle.

Capturing a Fish in the Operating Tank.

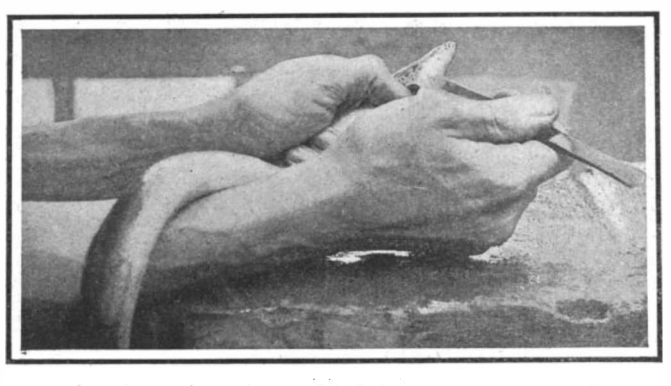
Removing Fungoid Growth from a Carp's Gills.

Massaging a Fish to Reduce Swelling of Air Bladder.

Lancing to Reduce Air Bladder Pressure.



Operating on a Diseased Fin.



Removing Growth from the Gills of an Eel.

of fungus about the gills. The fish, which has been previously placed in the operating tank, is carefully lifted therefrom by means of a net. The surgeon then grasps the patient firmly, but as gently as possible, with the left hand, and with a scalpel held in his right removes the foreign substance. Abscesses are also lanced, but it is seldom that these operations prove successful, and they are only resorted to in extreme cases. The reader, after a moment of thought, will realize the unusual difficulties which beset fish surgery. A fish is a creature of the water. It is impossible for it to sustain life in the air for more than a limited period of time. Just as soon as it is removed from its natural element, it begins slowly to die. Indeed, an operation on a fish is performed under much the same conditions as would obtain if a surgeon were to remove a human patient from his warm bed and hold him beneath cold water while he plied his lancet.

Nevertheless, fish surgery is by no means an unbroken record of failures. On the contrary, and despite its attendant difficulties, some notable successes have been scored. Perhaps the most daring piece of work that has been performed at the New York aquarium was the removal of a fungoid growth from one of the fins of a five-foot shark, while the most difficult was the grafting of skin upon an eel. That the latter proved a slippery patient, the reader will readily conjecture. Indeed, the holding of piscine patients while they are being operated upon is a serious problem, which must be solved by means of specially-made boxes, soft wrappings, and the like contrivances.

The most frequent successful operations are performed upon fishes whose air-bladders fail to effect their proper functions. The chief cause of such defects is the too rapid removal of a fish from the water to the air, as when it is captured, or removed from one tank to another. It is brought quickly to the surface with its mouth open. Its air bladder is charged to a greater or less extent with water, which enables it to maintain its specific gravity in deep waters. But the suddenness with which the fish is jerked out of its natural element prevents it from correctly adjusting the quantities of air and water in the bladder, and congestion results. When returned to its tank, the wretched creature is unable to sink or rise at will, and is washed about by the movements of the water in a helpless condition.

It has been found that fishes injured in this way may often be cured by a little gentle massage. The operator grasps the fish firmly with the left hand by the tail, draws it carefully out of the water up an inclined board reaching into the tank, but allowing the head and shoulders to remain submerged. Massage is then commenced toward the gills; and generally, after a few minutes' action of the hand, the air is forced out of the bladder.

Massage does not always prove successful in relieving the trouble, however, and more drastic measures have to be resorted to. In the case of a deep-sea bass, which had lost complete control of its air-bladder, and lay wallowing on the surface, quite unable to sink or swim, it was recognized that a remedy must immediately be found if the fish were to be saved. The bass was taken from the water, and a surgeon's needle inserted just behind the pectoral fin into the air bladder. The air was thus liberated, and the patient was again able to control itself perfectly. A few days in a hospital tank healed the slight puncture, and effected his complete cure.

This fish seemed fully to appreciate the service which had been rendered him. Indeed, those who have charge of sick fishes aver that their patients appear conscious that they are being treated for their good. Fishes which in the normal condition of good health are fierce and wayward become docile when they have been for a short time in hospital. Moreover, while care is necessary in the mixing of fishes of different species in ordinary circumstances, this does not apply to the hospital tanks. Patients which would be ready to fight to the death when in health, become perfectly companionable when laboring under the common misery of disease.

In contrast to this, it is interesting to learn that a convalescent fish must not be returned at once to his old tank. Either he, with his renewed vitality, will evince a pugnacious desire toward his old companions, or they on their part may set upon him and slay him. In fine, it is found necessary to exercise the utmost caution when introducing a stranger fish to a tank. At the New York Aquarium an angel fish (whose name, by the way, did not fit with his nature) had to be sentenced to solitary confinement because of his vicious propensities. He had killed two of his comrades, and exhibited every intention of trying his strength with others, when he was removed from the tank.

In conclusion, it may be said that the keepers at a big aquarium become wonderfully adept at diagnosing the condition of their charges. By merely looking intently through the glass walls of the tanks, they can tell whether the inmates are well or whether they show symptoms of disease. Just as the reader is able to say that his friend is ill or well by looking in his face, watching his behavior, and so on, the fish keeper is warned by the appearances of his charges as to their physical condition. A black bass dying from asphyxiation, for instance, becomes pale and wan in aspect, though five minutes after death it regains its natural color. Other sickly fish exhibit changes of color, or they swim and feed in an abnormal manner; and from these signs the attendant argues that he has patients for the hospital. This watchfulness has been the means of saving many valuable fish lives, both in the big New York Aquarium and in similar institutions in Europe.

How to Construct and Operate a One-Man Airship.

BY CAPT. THOMAS S. BALDWIN.

After thirty years of knowledge and experience in aeronautics, I feel that I can give a few data that will enable the young inexperienced aeronaut to arrive at better results than he seems able ordinarily to obtain.

In constructing a small dirigible balloon, the first and most essential thing is to make a perfect envelope, which can only be had after careful labor. Cotton may be used, but silk makes by far the better gas bag. It is three or four times as strong as cotton, and will last indefinitely with proper care.

The silk must first be cut in lengths of from twenty to thirty yards, according to the size it is desired to make the envelope. Next the silk must be given a thorough bath, in either linseed or spar oil, and hung up by one end to dry, so that the oil will run to the bottom and dry evenly. The drying process depends on the climatic conditions, and I have had it take from one week to five months for my silk to dry. The silk must be thoroughly dry before cutting and sewing.

After the silk has been prepared, the next step is to make a pattern for a single gore of the gas bag, or for a half or at least a quarter of such a gore.

In drafting and cutting the pattern, great care should be taken to see that it is absolutely correct in outline, as if there is the slightest irregularity the silk will draw and tear. The edge of each gore should be cut on a curve which is laid out in the following manner upon a paper pattern: A strip of paper of the same dimensions as a length of the silk is fastened horizontally on a wall. A string is then suspended from two tacks placed at each end of the strip, midway of its width, and allowed to sag until it touches the bottom of the strip. The line thus formed will be the desired curve. The only point to remember is that the gores must be of the proper width to give the desired circumference at the center and that there must be enough margin left to allow for overlapping the seams. Once the pattern is obtained, the cutting is easily accomplished.

I have found the most economical and reliable one-man airship to be one made to the dimensions of my "California Arrow," the length of which is three times the diameter, while three and a half times would still be a good proportion. The seams should all be double stitched. The strips are first sewed together with a plain seam about ½ inch from the edge. The raw edges are then turned under about ⅛ inch, and sewed down by a second line of stitching ¼ inch from the first line, thus forming a lap seam. The sewing should be done with good silk.

About two feet from the bottom center of the envelope, make a large neck, or manhole, so the bag can be turned wrong side out and varnished. Directly above this manhole, in the top, a 14-inch valve may be fitted. Although the valve is merely a matter of personal desire, I do not advise building an airship without one. Should the valve be inserted, there must be a cord coming down to the manhole, so that it can be used if needed. About four feet back of the manhole, put in a small neck about six inches in diameter, for filling the bag with gas.

Now the bag being sewed and ready for the coating of varnish, take a six-inch brush and after the envelope has been blown full of air, so that it will hold its shape, commence at one end and paint one or two gores the entire length of the bag. When these have been very carefully done, take the next two gores, and so on until the entire envelope has had the second coating. After this is absolutely dry, turn inside out and do the same thing over. These coats of varnish must be put on until the envelope is air tight, and there is no leakage. Be careful to watch the envelope when filled with air, as the change in temperature will cause the air to expand and is liable to burst the bag, but after watching it a day or two, the hours for expansion and contraction will soon be learned.

This envelope should be entirely incased in a linen square mesh netting, and never a diamond shape, as there will be no end of give with the diamond mesh, and it will be difficult to control the airship when in the air. The squares should be about six inches, and for a ship the size of the "California Arrow" there should be about sixty suspension cords of alternately 6 and 8 feet in length, placed some two and a half feet apart and extending the entire length of the frame. There will be two cords on each point of the finished netting, one for the top and one for the bottom of the frame.

The frame, which is about 45 feet long, should be built of 1½-inch Oregon spruce. It is in the form of an equilateral triangle, and it should be braced every three feet with a 1½ x ½-inch strip, the panels thus formed being braced diagonally with piano wire.

The frame should hang about six feet from the bottom of the envelope and should be perfectly adjusted, so that an equal strain will come on each suspension cord.

The propeller should be a two-bladed one, ten feet in diameter, with the pitch about equal to the diameter, and a blade width of 18 inches at the tip. It should be geared to make about 175 revolutions per minute, which is a peripheral speed of the blades of 5,498 feet per minute. The longer the blade and the slower the speed, the more efficient is the propeller within certain limits. The propeller shaft should be made of 16 gage, 1¼-inch seamless steel tubing. The rudder should contain a surface of 36 square feet.

A 7-horse-power air-cooled motor of about 50 pounds weight is sufficient power for this size airship, as the full power of a larger engine cannot be used, and for the novice a 7-horse-power engine is quite sufficient. The motor should be placed about one-third of the distance from the front of the framework and suitably geared to the propeller. A clutch can be fitted if desired, but this is not absolutely necessary. The engine should be carefully watched at all times, as the success of an airship depends upon the motor. The engine should be rigidly inspected each time before going in the air, and special attention should be given to its lubrication, which must be very thorough.

During 1907 I made ninety-two starts, returning to the exact starting point ninety-one times. On the one trip from which I did not return under my own power, the wind came up stronger than the thrust of the propeller, and therefore I was helpless, but my valve gave me the means of a safe descent. Never go into the air when the wind has more power than you have, and you will have little or no trouble. An eight-mile-an-hour wind is a safe limit, although an experienced operator can operate in a wind of from twelve to fifteen miles an hour. Accidents are not necessary if the operator is sure that everything is in working order before he makes an ascension, for when you are once in the air, and things go wrong, it is then too late to remedy them and you will have to take the consequences.

Following are the dimensions of the "California Arrow," which may be used as a pattern: Length, 52 feet; diameter, 17 feet, with a capacity of 9,000 cubic feet. Made of the best Japanese silk, coated with linseed oil varnish. Irish linen netting. Frame, equilateral triangle, 45 feet long by 3 x 3 feet wide, and equipped with a Curtiss 7 horse-power motor of 50 pounds weight. Two-blade screw propeller, 10 feet in diameter and 10-foot pitch, with 18-inch width of blade at tip; peripheral speed, about 5,000 feet per minute. Shaft connected with a countershaft, but no clutch is used. The speed is controlled by a rod eight feet long extending forward from operator to motor and connected to the throttle. The rudder contains 36 square feet of surface. The tiller rope is continuous and passes around a pulley in front of the operator. The rudder can thus easily be controlled by one hand. One thousand cubic feet of gas will lift 65 pounds. The formula for making the gas is 1,000 pounds of sulphuric acid, 1,000 pounds of iron, 5,000 pounds of water, which should generate 3,500 cubic feet of gas.

After the frame and engine and all connections are finished, the airship is ready for its first flight. The airship, of course, is supposedly under cover and protected from bad weather while waiting for the start. The very last thing to do before leaving the aerodrome is to ballast the airship. Mount the frame and arrange things so that the center of balance is about 5 feet back of the motor. Add or take from the ballast until there is about three pounds of ascensive power, and then you are ready for a flight. This should be done about fifteen or twenty minutes before the time of ascension, so that there will be no delay whatever when the minute arrives. After stepping from the frame and having the ship anchored, walk around and look carefully over everything. The manhole and inflating neck should be made into a safety valve, by taking up several inches and twisting an elastic band around several times, so that in case high altitude or heat from the sun's rays causes expansion, the bands will blow off and give warning before the envelope will rip.

A large open field is preferable for the trial flight. Two saw horses about 4½ feet high will be needed to set the airship on, before the flight, so that when starting the engine the propeller will not strike the ground. Now the airship, we will say, is in the field and you are on the frame with the engine working all right. The rudder ropes are free, and everything all ready.

You should have a drag rope of 100 feet attached to the frame about one-third from the back end. This should be carefully laid on the ground free from everything, so that when you rise it will not become entangled. You take your seat slightly back of the center of balance, with the engine running, and when you give the signal, the saw horses are knocked out from under the frame, and you ascend at an angle of about 10 degrees by stepping back a foot or two upon the frame which you are straddling. You now must use your own judgment about your flight, as to how long it will be and where you will try to go, but be careful not to turn your rudder too quickly. This should be operated by two tiller ropes, one in each hand. Move slightly forward for descent, and backward for ascent. The spark and throttle control rods run back along the frame, and can be operated at all points where you stand. In coming down stop the motor about 25 or 30 feet from the ground, and have some one to catch the frame and save the propeller from striking the ground. With proper judgment the airship should come back to the exact starting point, even as close as one or two feet. After the flight is ended, take the airship back to the aerodrome, guy it down carefully, shut off the gasoline, disconnect the spark, and watch the gas bag for expansion. With proper care the airship should stay in that condition indefinitely, and be ready for another flight when you so desire.

A Correspondence School of Aeronautics.

(*Continued from page* 147.)

Five lessons will be supplied at one time, and the correct answers to the first set of questions will be sent when the second set is forwarded. The course will extend over a period of three months, and supplementary lessons on dirigible balloons and aeroplanes will be forwarded after being prepared by the French experts. Students who take this course will have the free use of a very complete library containing books and the leading magazines on the subject, as well as of a large number of stereoscopic photographs showing balloons, aeroplanes, etc., in flight. At Mr. Triaca's office, No. 108 West 49th Street, New York city, may also be seen models of balloons, aeroplanes, propellers, and motors, as well as samples of all kinds of accessories used by aeronauts. Among the privileges granted to students are that of consultation with the technical staff in Paris, and the benefit of the advice and assistance of its members; a balloon ascension either here or in Europe, which will be allowed to one student out of every twenty, the student to be selected by drawing lots; arrangement for special ascensions for members at a reduced cost whenever desired; and a 10 per cent discount upon subscriptions to aeronautical papers as well as on aeronautical instruments. At the conclusion of the course, each student will receive a suitable certificate.

IMPROVEMENTS IN TIMERS.

Pictured in the diagram directly opposite is a timer of the usual roller type, except that it is equipped with a novel self-cleaning device and also with a positive ground contact. The cleaning device consists of a brass gauze brush inclosed in a fiber cap or retainer, and equipped with a spring which presses the gauze brush lightly against the track or surface on which the roller revolves. The gauze brush wipes or scrapes away any dirt, worn particles, or metal that might accumulate on the contact surface, and also the deposit that is formed by the arc of breaking contact as the roller leaves a contact segment. On account of this surface being clean at all times, it is possible to use much shorter segments and a much larger roller. The slippage or drag usually found in small rollers is done away with, the roller making but three and one-half revolutions to a complete turn, whereas from eight to eleven usually constitute a turn.

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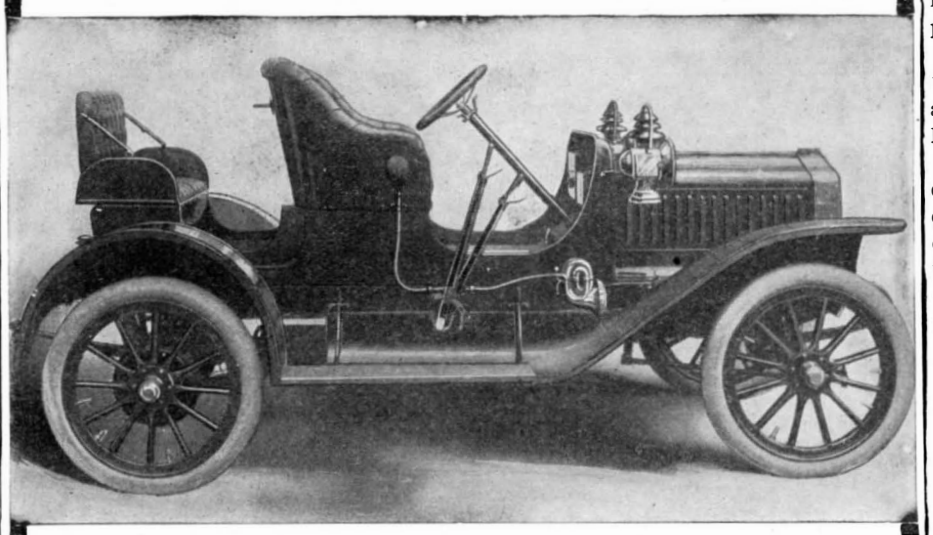

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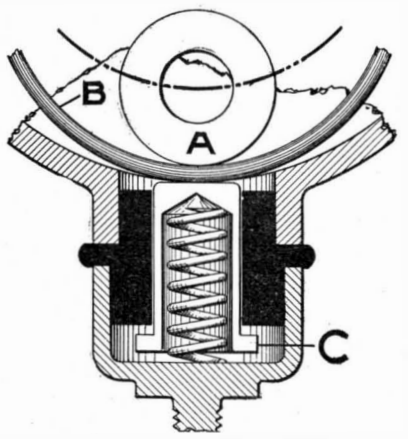
It is claimed that the ground contact, which consists of a brass plunger equipped with a coil spring which presses the plunger against the end of the timer shaft, will increase the speed and insure regular firing of the engine. This contact plunger is provided with a binding post and gravity nut, to which the battery ground wire is fastened instead of on the engine or frame of the machine. This is placed in the cap or cover of the timer, giving a direct ground contact, and thus overcoming much of the trouble caused by different cylinders of the engine missing fire, that has heretofore been laid to coils, carbureters, plugs, batteries, and wiring. When the ground wire from the battery is fastened to the frame or engine, the current must pass into the engine through the cam-shaft bearing and out of the cam-shaft to reach the timer. The fault in this is that the cam-shaft bearing is soon worn enough to result in a poor contact, the oil in the bearing also tending to retard the current. When the current fails to flow through the

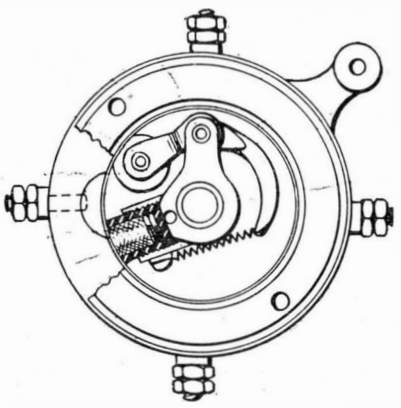


A RING AND ROLLER TIMER.

circuit, the resulting miss-fires decrease the power, and should there be a surplus of oil in the cylinder, some of the oil is thrown on the plug by the piston. When the plug fires again, the oil is burned on the plug and soon forms a carbon deposit, which stops the action of the plug. Again, a motor that is missing is apt to give off soot from the cylinder which is missing. Successive charges of gas being drawn into a cylinder and not exploded, cause the cylinder to become wet with gasoline. When this cylinder does fire, the mixture is very heavy; hence the soot and short-circuiting of the plug.

The other of the illustrations shows a timer which has been improved by the addition of a loose ring between the roller and the contacts.

The difference in the diameters of the outside of the loose ring and the inside of the case in which it rolls assures a constantly changing point of contact for the action of the current. The slight



TIMER WITH CLEANING DEVICE.

abrasion consequent to this action and the slight mechanical impact of the contacting points are thus distributed over a large area. The ring, when rolled upon a contact point, acts as a direct conductor for the electric current into the case proper, bridging a gap of about one-quarter of an inch. As it is made of brass, the resistance is slight. It also distributes the action of the arc made when the contact is broken over the contact's entire surface. This loose ring consequently takes much of the mechanical wear from the roller inside, and the contact

is made outside over an area much greater than the combined areas of similar surfaces on a number of the ordinary types of roller timers. The ring when worn can be removed and replaced with the fingers, and its renewal means but a few cents and a moment of time.

The contacts of tool steel are made hollow to accommodate a bronze spring, which holds them uniformly in their normal position projecting through the case. They are carried by a tube of fiber which extends nearly through the case, leaving a circular recess around the contact, which is smaller in diameter than the width of the loose ring. In passing over the spring-pressed contacts the ring does not leave the outer fiber casing within which it rolls.

The action of the ordinary roller timer, in which the contacts are imbedded in the insulation, is to deposit upon the latter small particles of burned metal disintegrated by the arc, often to such an extent as to bridge the gap from one contact to another or to increase the length of contact at one or more points, thus causing unequal ignition. This action in the ring and roller timer simply deposits the metal particles from one metal surface to another without in any way altering the timing.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

POCKET.—L. HARTEL, Cherryvale, Kan. The object in this case is to provide a pocket adapted to contain money, papers, valuables, and the like, and having means for securely locking the pocket to prevent the unauthorized removal of objects therefrom. It is adapted to resist attack when an attempt is made to sever the material comprising the pocket, with a cutting implement.

SKIRT AND WAIST HANGER.—C. W. HEWLETT, New York, N. Y. This improved article is more especially designed for supporting or hanging such article of apparel as a skirt and waist, and embodying in its construction a safety-pin, a hook depending therefrom, and an inwardly-projecting loop for suspending the pin and hook and the garments placed thereon.

Of Interest to Farmers.

COTTON-CHOPPER.—G. B. GAUNTT, Taylor, Tex. In operation the machine is driven with the wheels thereof on each side of the row, and in motion the hoe shaft through its connection with the driving shaft is rotated to bring knives into engagement with the plants near the top of the ground to cut them down. By operating a catch lever, the rear end of the hoe shaft may be swung from side to side whereby to follow the convolutions of the row, and by operating another lever, the rear end of the shaft is elevated to raise or lower the hoes in accordance with the height of the ridge upon which the plants grow.

Of General Interest.

APPARATUS FOR MANUFACTURING FUEL.—P. HOERING, Berlin, Germany. In carrying out his invention Mr. Hoering makes use of the heat contained in the steam of the gaseous admixtures and brings about a chemical reaction upon the matters to be gasified, whereby the yield of tar and ammonia is considerably increased. The waste gases can be used for heating the oven from the outside. This application is a division of one formerly filed by this inventor for an improvement for coking hydrous bituminous combustibles.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 18, 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acids, making dialkylbarbituric, M. Engelmann	879,156, 879,835
Acids, manufacturing dialkylbarbituric, Stephan & Hunsalz	879,499
Adhesive plasters, cutting and stripping device for spool, W. J. Walsh	879,223
Adjustable box or bearing, G. M. Hinkley	879,265
Adjustable brace, J. B. Collins	879,524
Air brake, lighting and signaling system for railway trains, Mayo & Houlehan	879,397
Air compressor or pump, W. H. Tew	879,213
Air purifying apparatus, J. H. Kinealy	879,273
Air ship, E. F. Leeds	879,779
Air treatment apparatus, fresh, L. P. Leonard	879,391
Amalgamator, J. S. Marquette	879,825
Ammunition hoist control, J. D. Ihlder	879,387
Amusement device, C. I. Enochs	879,615
Amusement walk, G. Lacomme	879,275
Animals from stables, means for releasing and leading, J. W. Ross	879,323
Annealing apparatus, wire, J. H. Roberts	879,674
Annunciator, Mayo & Houlehan	879,288
Arbor, O. Rose	879,829
Antislipping and non-wearing medium, C. D. McGiehan	879,790
Automobiles, etc., tire and luggage carrier for, J. J. Bond	879,511

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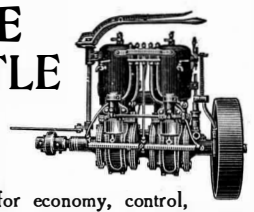

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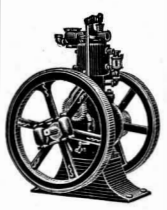

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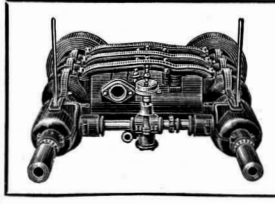

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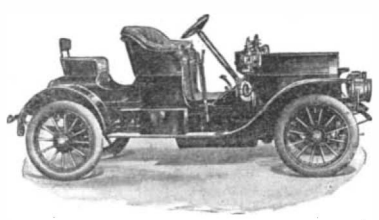

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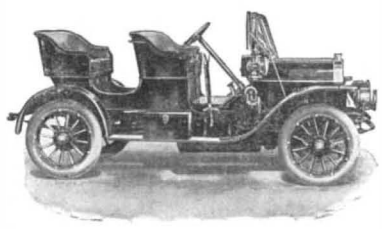

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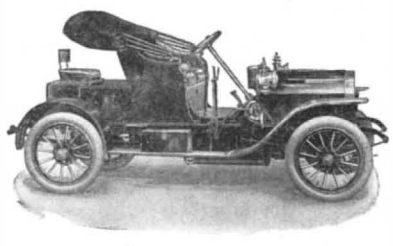

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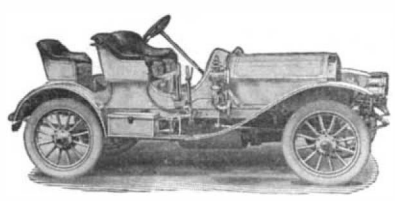

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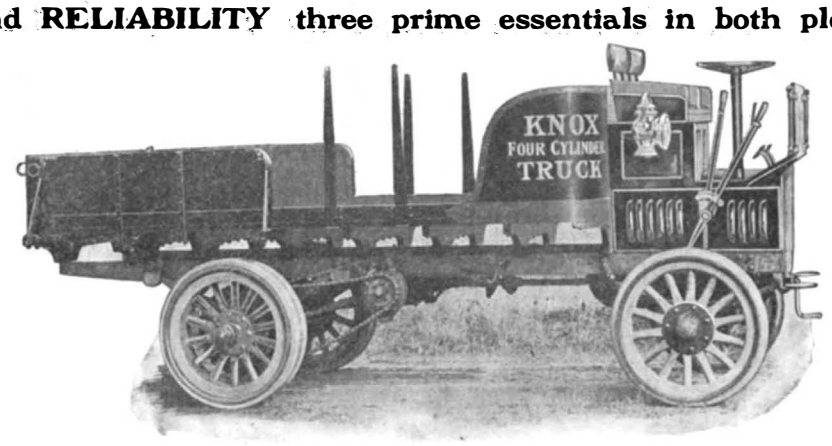

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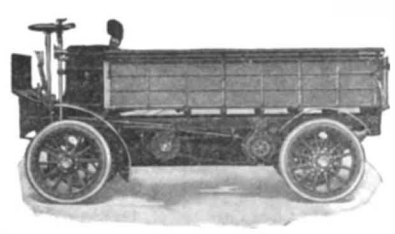

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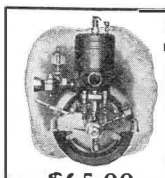

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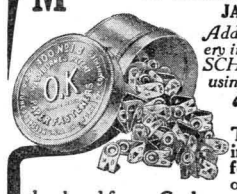

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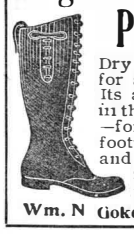

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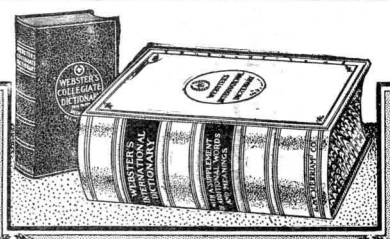

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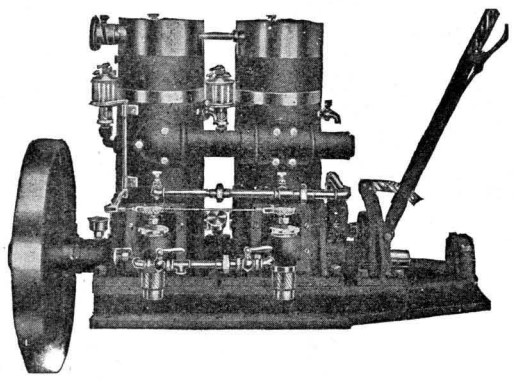

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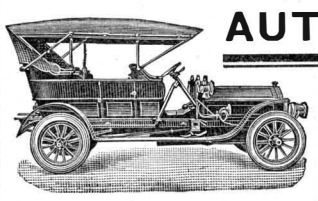

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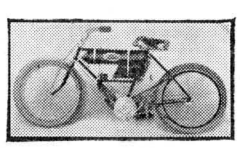

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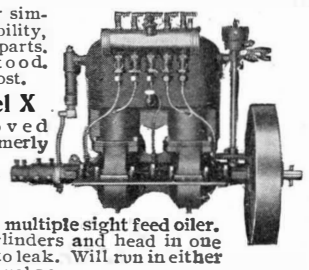

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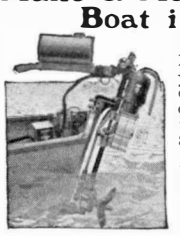

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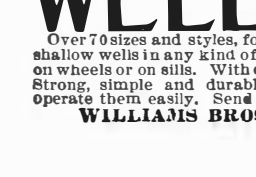

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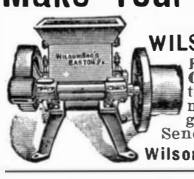

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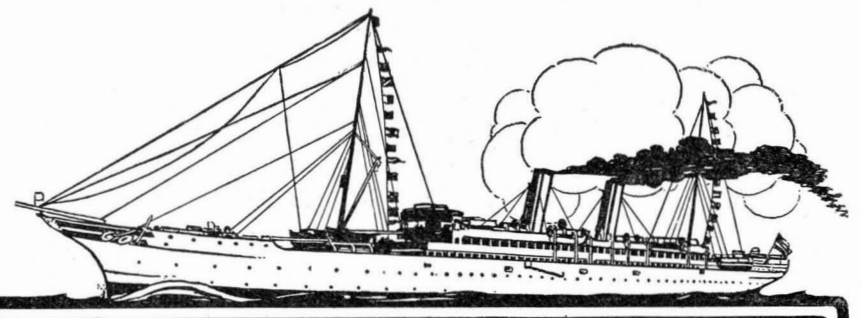

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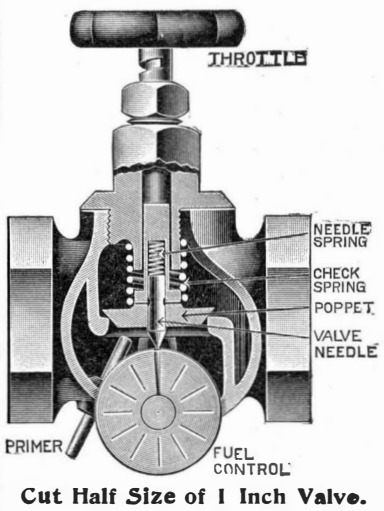

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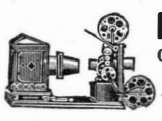

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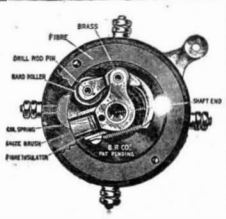

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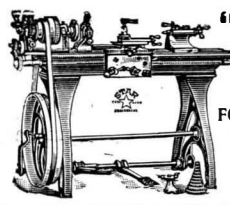

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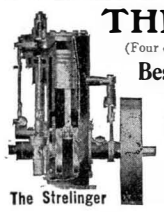

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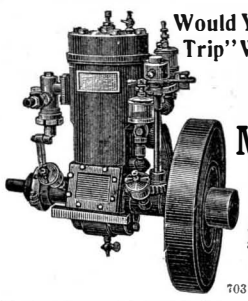

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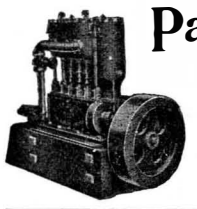

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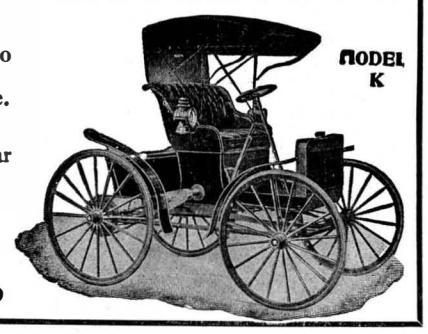

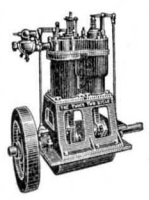

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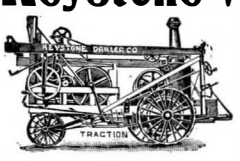

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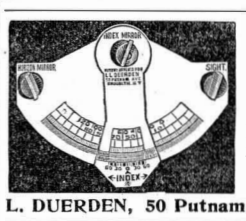

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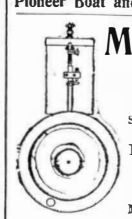

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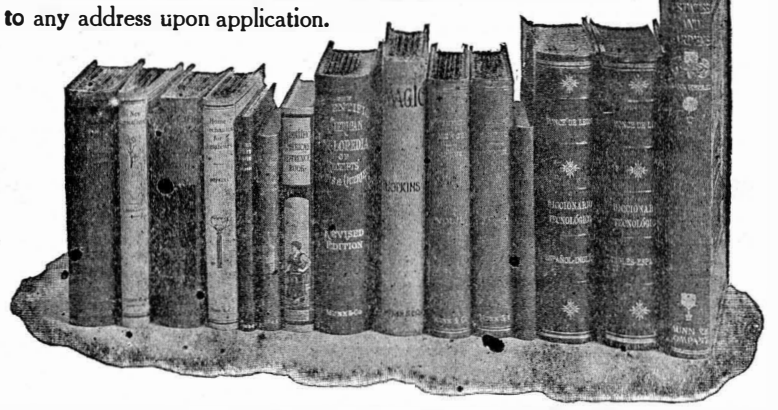

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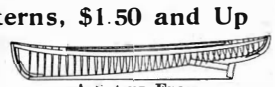

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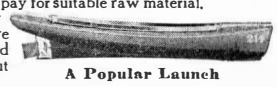

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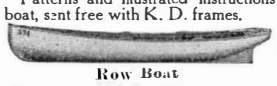

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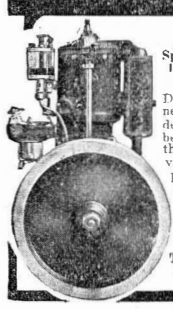

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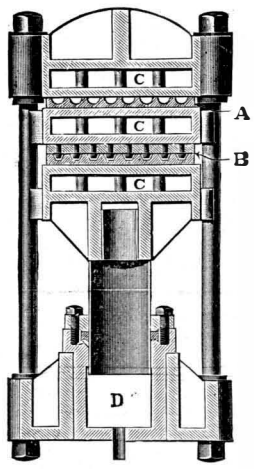

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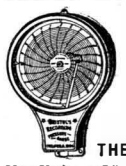

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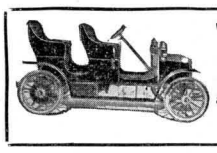

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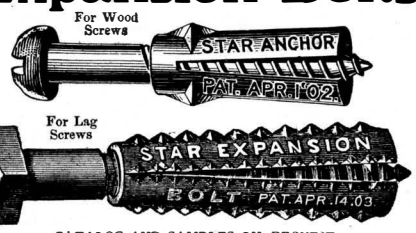

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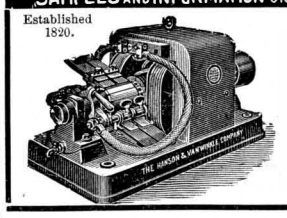

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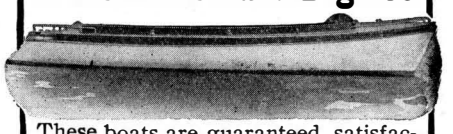

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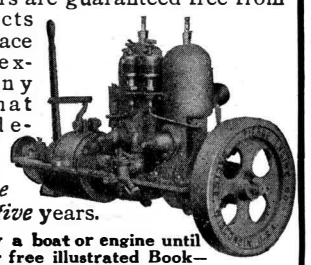

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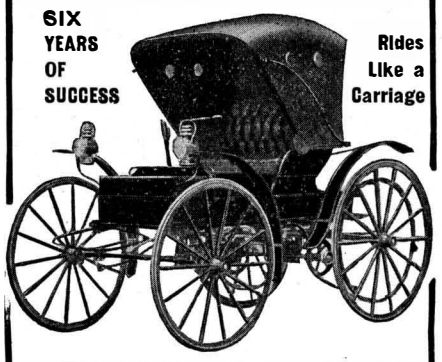

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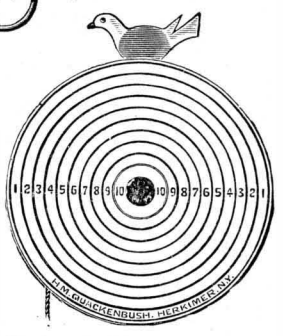

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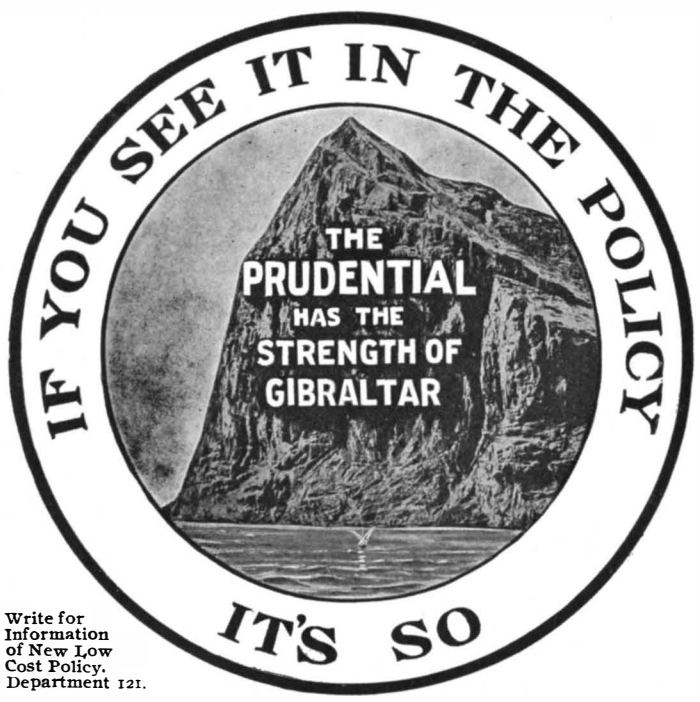

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